CIO

THE MAGAZINE FOR INFORMATION EXECUTIVES

MAY 1991
VOLUME FOUR NUMBER EIGHT
SEVEN DOLLARS

SPECIAL
COMMUNICATIONS
ISSUE:

Sharing The Wealth

A Look At Distributed Computing

AN INTERNATIONAL DATA GROUP PUBLICATION

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CIO

VOLUME 4, NUMBER 8

SPECIAL REPORT: DISTRIBUTED COMPUTING

Sharing the Wealth 39

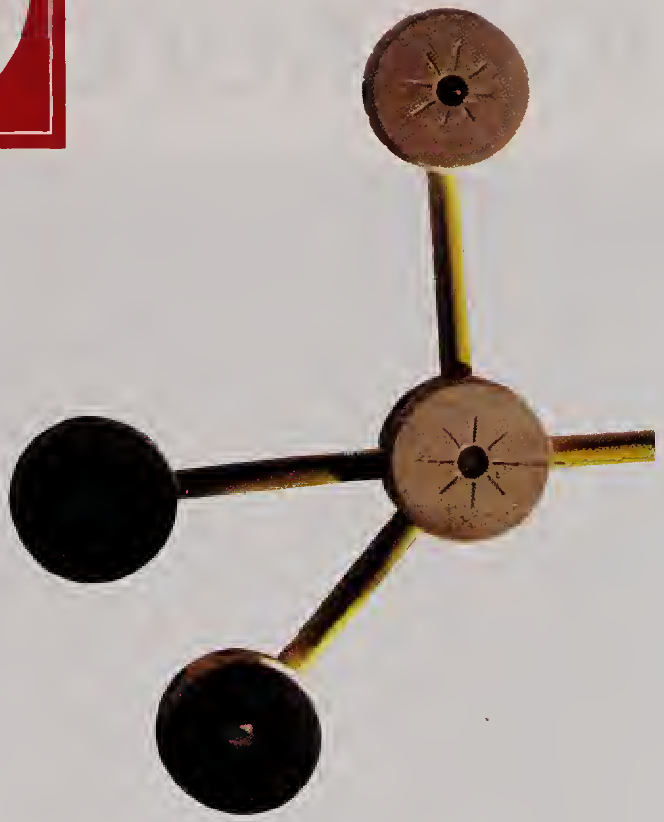
Distributed computing enables organizations to link all their information resources and the people who use them. But getting there is no simple task.

By Allan E. Alter

Looking at the Options 44

The term distributed computing has become a crucible for network architectures ranging from rudimentary distributed databases to sophisticated cooperative processing.

By Thomas Kiely



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When designing a distributed computing structure, savvy CIOs know it's folly to try to pound a square peg into a round hole.

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The irony of distributed computing is that bringing power to the people also means bringing new problems of command, control and burden-sharing to CIOs.

By Paul Konstadt

The Salience of the LANs 72

Today's LAN environments have reached a higher state of being than their strictly departmental forerunners. In turn, they require increasingly complex management structures that often affect the entire IS kingdom.

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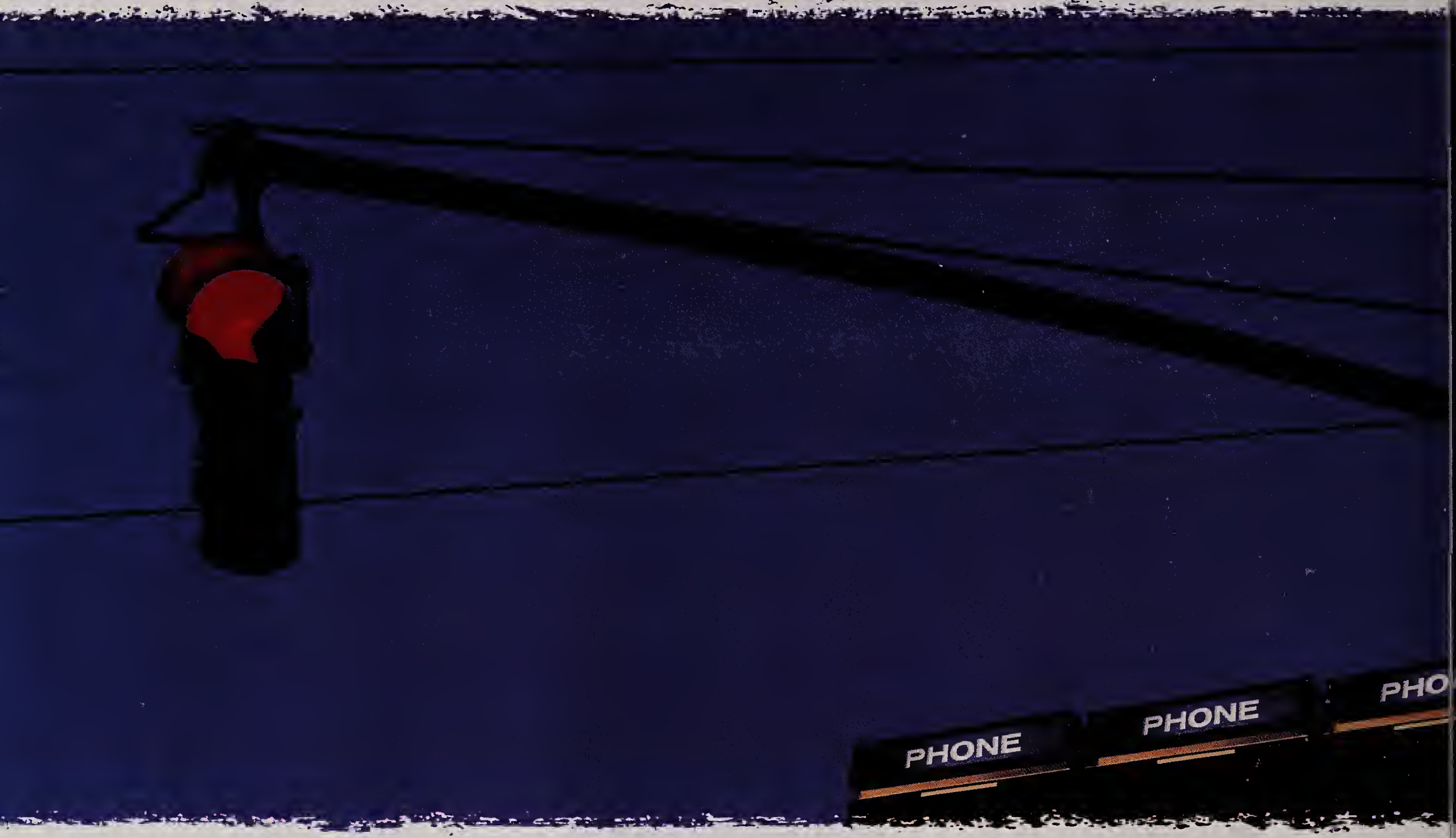
The end of the road for overcharges.



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Understanding communications standards is a crucial yet often baffling part of CIOs' jobs these days, so we asked a few pundits and practitioners to help shed some light on the subject.

By Allan E. Alter

A Communications Primer 95

Making sense of the distributed world.

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When used to its full potential, voice mail can be a powerful and versatile tool for increasing productivity and achieving competitive advantage.

By Gus Bender

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Industry participants and observers assess the year in communications.

By Megan Santosus

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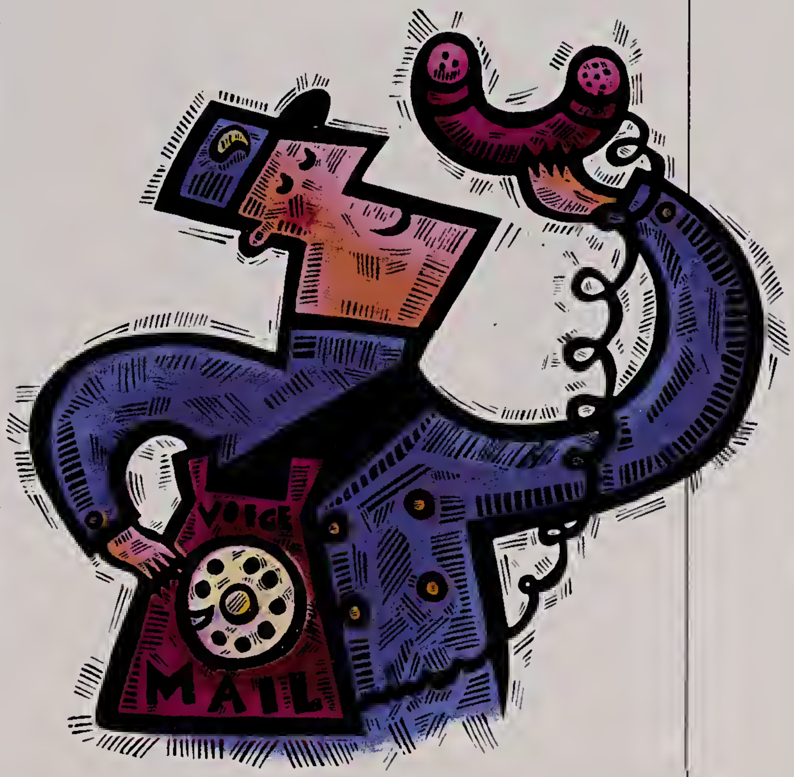
The next step in your organization's pursuit of ultimate connectivity may be to sever some of its hard-wire connections.

By Scott Wallace



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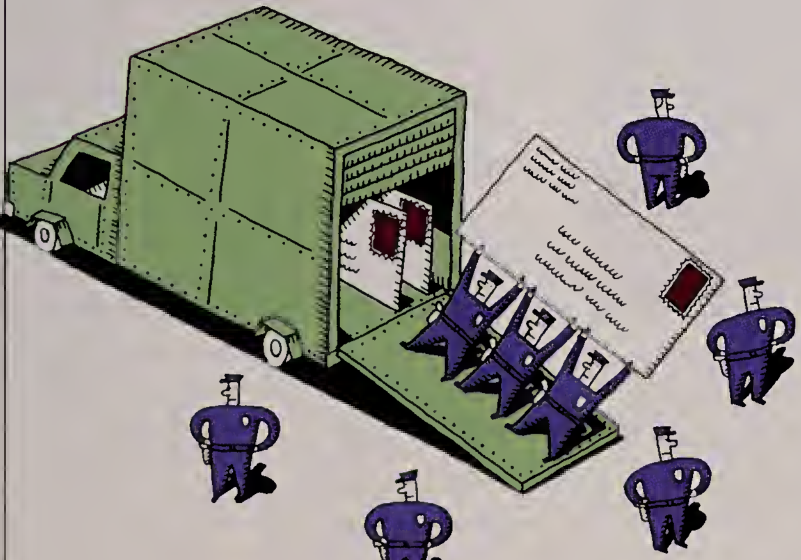

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unprecedented quality, prod

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Vice President
Director, Information Systems
J.C. Penney

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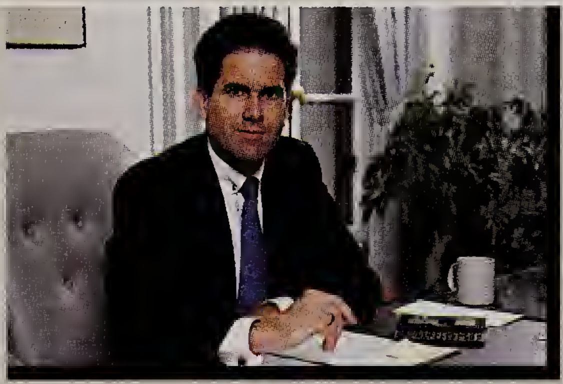

"The strengths of the IEF are clear-cut. One obvious quality advantage is that application changes are made to diagrams, not code. This ensures ongoing integrity —the specification always matches the executing system."

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"I've seen other CASE tools fail, so I raised the bar high when we evaluated the IEF. It passed with flying colors. I could not be happier with my decision to adopt the IEF company-wide."

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Wal Budzynski
Head of Operations, Systems/Computing
Rolls-Royce

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Cloene Goldsborough
Director of Data Resource Management
TWA

"Our first IEF system was completed faster, and with fewer errors, than any system I've ever seen. If I had to go back to the old ways, I'd find another job...outside the DP world. It means that much to me."

Mogens Sorensen
Chief Consultant
Nykredit (Denmark)

op information systems with uctivity and maintainability.

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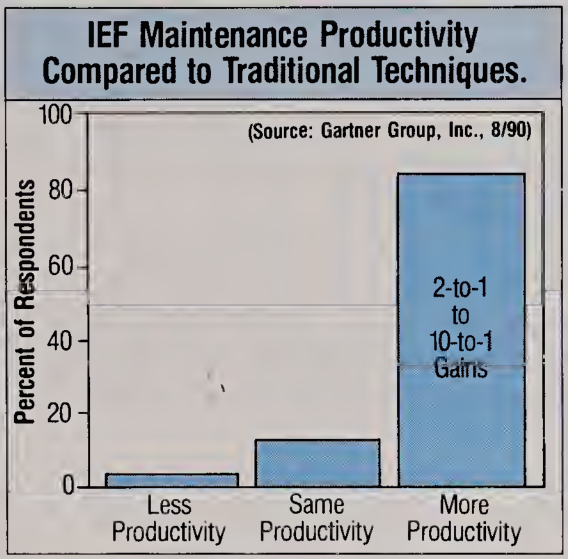
The quality of IEF-developed systems is remarkable. In recent CASE research by The Gartner Group, application developers were asked to report the number of abends they had experienced. (An "abend" is a system failure or "lock-up" caused by code defects.) *IEF developers reported zero defects—not one abend had occurred in IEF-generated code.*

Maintenance productivity gains of up to 10-to-1.

In this same study, developers were asked to compare IEF maintenance productivity with their former methods. Of those responding, *more than 80 percent had experienced gains of from 2-to-1 to 10-to-1.* (See chart.)

Specifications always match the executing application.

With the IEF, application changes are made to diagrams, not code. So, for the life of your system, specifications will always match the executing application. The Gartner Group research showed that *all* IEF users who reported making application changes made *all* changes at the diagram level.



Developers were asked to compare IEF maintenance to former methods. Of those responding, more than 80% reported productivity gains of from 2-to-1 to 10-to-1.

Mainframe applications can be developed and tested on a PC.

With our new OS/2 toolset, you can develop mainframe applications, from analysis through automatic code generation, on your PC. Then, using the IEF's TP monitor simulator and the diagram-level testing feature, you can also test these mainframe applications without ever leaving the PC.

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Full-service support.

Of course, our technical support, consultancy, training courses, satellite seminars, and other informational assistance will continue apace. We also offer re-engineering and template services. This full-service support will remain an integral part of the IEF product.

For more information, including a VHS video demo, call 800-527-3500 or 214-575-4404.
Or write Texas Instruments, 6550 Chase Oaks Blvd., Plano, Texas 75023.

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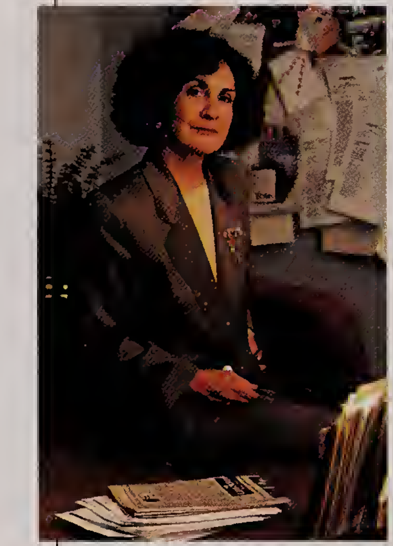

One year ago we published a special issue devoted to the topic of communications. Like our readers, *CIO* Magazine's editorial team was breaking new ground by exploring what communications meant to IS executives. In response to editorial surveys, our readers continue to tell us that communications—an amorphous and formidably broad term—is a primary and growing concern and a topic they need to know more about. To satisfy this need, we've reported on quite a few communications issues during the past year, including putting together global networks and managing local area networks.

The passage of time has a way of bringing a newer, sharper perspective to matters that once seemed confusing. So when we set out to create another special communications issue this year, we were pleased to learn that readers and communications gurus alike suggested we focus on the realm of distributed computing.

The first hurdle was coming up with a good definition of distributed computing. After settling on that, Special Projects Editor Allan E. Alter and *CIO*'s editorial group fanned out to explore the terrain.

The message that came through loud and clear was that distributed computing is something of a paradox. While it puts data and applications close to those who need information and computing power, controlling the distributed computing environment requires a centralized mainframe mentality. This bifurcated reality has an enormous impact on how CIOs approach their enterprises' communications agendas. Many CIOs told us that the clear organizational relationships that once existed between IS and user departments dissolve as distributed computing becomes more ingrained in the organization. Today CIOs need to be in control of the computing power, but they cannot be autocratic or arbitrary about the way they manage it. Information executives are creating solutions to this situation by sharing power with users while finding ways to maintain and increase central control of the computing backbone.

IS executives are also finding that there is a dearth of tools to manage the variety of networks that comprise a distributed computing environment. It looks as though those tools will arrive in the not-too-distant future, but until then savvy CIOs have to be fluid and flexible and build their own applications. While these may be angst-producing marching orders, more than a few IS executives report that the new environment is refreshing and adds new excitement to their roles.

Marcia Blumenthal

PHOTO BY WEBB CHAPPELL

CIO

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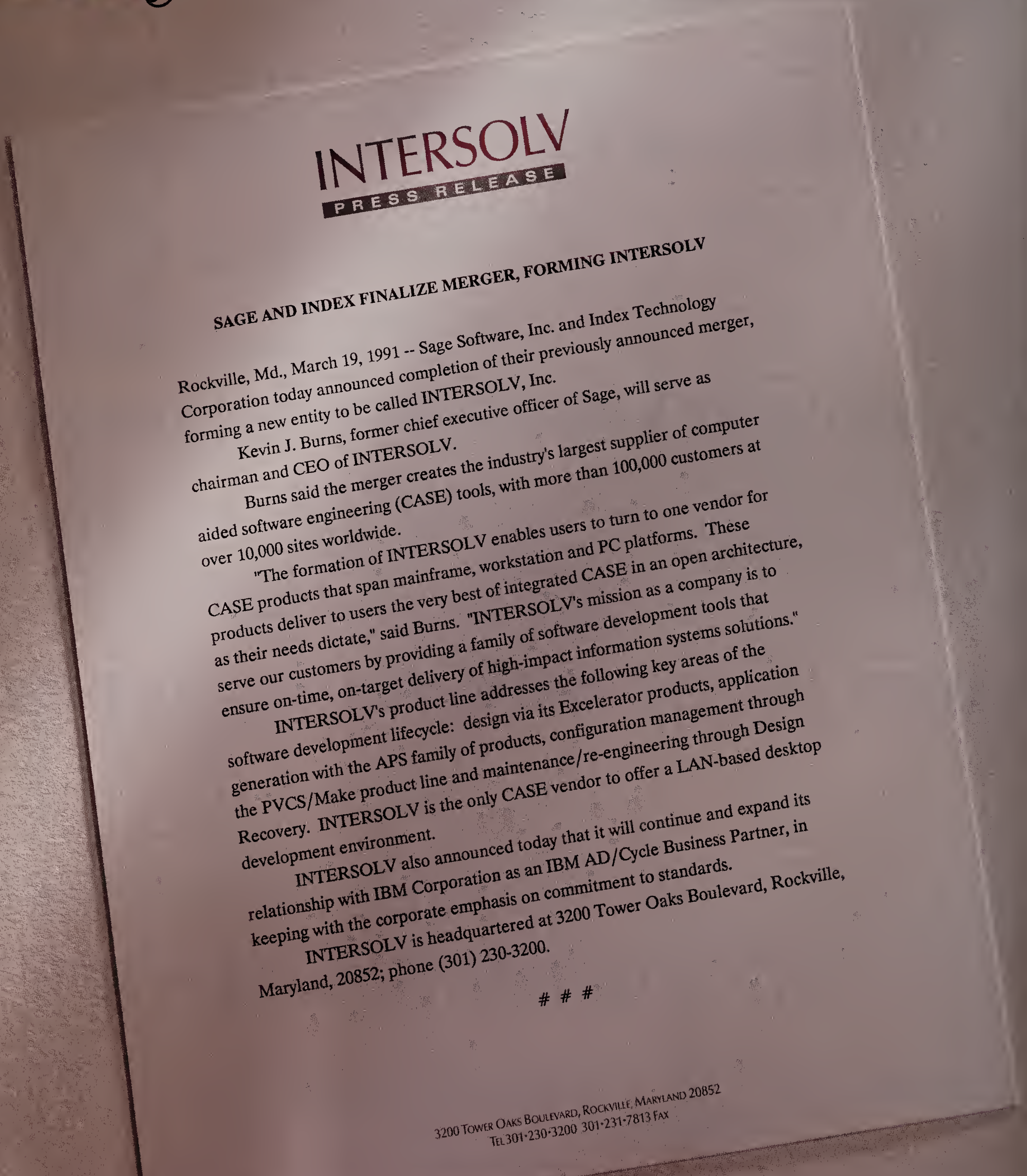

INTERSOLV
PRESS RELEASE

SAGE AND INDEX FINALIZE MERGER, FORMING INTERSOLV

Rockville, Md., March 19, 1991 -- Sage Software, Inc. and Index Technology Corporation today announced completion of their previously announced merger, forming a new entity to be called INTERSOLV, Inc.

Kevin J. Burns, former chief executive officer of Sage, will serve as chairman and CEO of INTERSOLV.

Burns said the merger creates the industry's largest supplier of computer aided software engineering (CASE) tools, with more than 100,000 customers at over 10,000 sites worldwide.

"The formation of INTERSOLV enables users to turn to one vendor for CASE products that span mainframe, workstation and PC platforms. These products deliver to users the very best of integrated CASE in an open architecture, as their needs dictate," said Burns. "INTERSOLV's mission as a company is to serve our customers by providing a family of software development tools that ensure on-time, on-target delivery of high-impact information systems solutions."

INTERSOLV's product line addresses the following key areas of the software development lifecycle: design via its Excelerator products, application generation with the APS family of products, configuration management through the PVCS/Make product line and maintenance/re-engineering through Design Recovery. INTERSOLV is the only CASE vendor to offer a LAN-based desktop development environment.

INTERSOLV also announced today that it will continue and expand its relationship with IBM Corporation as an IBM AD/Cycle Business Partner, in keeping with the corporate emphasis on commitment to standards.

INTERSOLV is headquartered at 3200 Tower Oaks Boulevard, Rockville, Maryland, 20852; phone (301) 230-3200.

# # #

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E Company That's s Since March 19, 1991.

The merger of Sage Software and Index Technology does far more than just bring together two strong CASE companies. It allows two companies with complementary strengths to focus on a common vision. A vision of where the market must go to fulfill the promise of CASE.

At INTERSOLV, our combined 17 years of CASE experience has taught us that you can't build applications in a hyperintegrated and closed environment. We have a unique solution: the benefits of I-CASE, but with a modular implementation approach that reduces up-front costs and risks.

Our solution takes into account the true realities of the 1990's development environment—development cycles, methodologies, how developers really work, and existing cultures.

Other CASE companies may have the right vision, but they use the wrong approach. Simply put, our approach is right because it gives you all the functionality you need, and it doesn't force you to change your culture and projects to fit a rigid model tool set.

It's a fact: Our products are designed to work together, alone, or in concert with other complementary products. What's more, our solutions span the entire development lifecycle. They include Excelerator for design, APS for application generation, PVCS for configuration management, and Design Recovery for maintenance/re-engineering.

Just as important, we're the only CASE vendor to offer solutions that support a true multi-user development environment using workstations and LAN server technology.

Add to that our commitment to an open architecture and adherence to industry standards such as IBM's AD/Cycle, and you finally have the flexibility needed to help you realize the full potential of CASE.

But don't take our word for it, ask our customers. There are over 100,000 who count on us every day.

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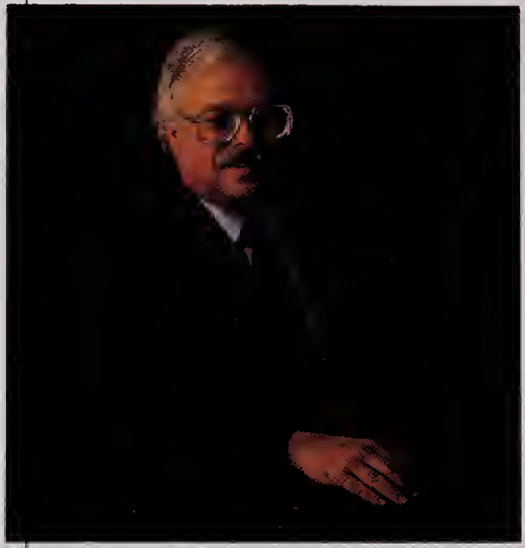
LETTER FROM THE PUBLISHER



As part of our continuing effort to stay on top of your changing needs, CIO Publishing recently conducted extensive discussions with our readers that revealed a need for more information on critical strategic issues having an impact on their planning cycles.

Many of you indicated that while you were pleased with the editorial focus and content of *CIO* Magazine, you wanted more. You identified six critical months—April, May, June, September, October and November—when you typically are involved in strategic planning and budgeting and need even more information from us on major IT topics such as open systems, interoperability and outsourcing.

In response, I'm pleased to announce that *CIO* will increase its frequency from 12 to 15 issues in 1991. Starting this fall, we will publish two issues in September, October and November. During these two-issue months, the "regular" issue of *CIO*, featuring topical articles and our ongoing columns and departments, will be published on the 1st. On the 15th, we'll publish an additional issue that will include a special-focus section on a key topic identified by you as critical to your future.

In 1992 we'll increase our frequency from 15 to 18 issues, publishing twice in April, May, June, September, October and November.

We're extremely enthusiastic about this upcoming change and are committed to retaining the quality, thoroughness and high-level focus you've come to expect from us. I'll be looking forward to getting your feedback on this. If you have questions or suggestions, don't hesitate to call me at 508 935-4601. Or write to me at CIO Publishing in Framingham, Mass.

P.S. Don't forget to mark your calendars for the next CIO Perspectives Conference, to be held Sept. 22 through 25 at the Hyatt Regency in Monterey, Calif. Several hundred Information Technology executives—including Tom Peters and Mike Vance—will meet to explore "IT and the Corporate Agenda: People, Productivity and Profit." Attendance is limited, so register early by calling us at 800 366-0246.

PHOTO BY GEORGE SIMIAN

Coming In CIO

The Myth of Strategic IS

There is a growing consensus among IT observers that the cherished notion of being able to obtain significant strategic advantage directly through an information system is obsolete—if it was ever valid to begin with.

Airline IT in the Post-Sabre Era

American's Max Hopper says strategic advantage is dead. So what's taking its place at the leading airlines?

The Conundrum of the IS Mission

IS is supposed to give users what they want, yet many users do not themselves know (or cannot articulate) what that is. Worse, users may *think* they know what can help without understanding the limitations of the technologies involved. Is there a way to solve this problem?

Getting Costs Under Control

Comparative analysis is a way of evaluating a company's costs in relation to those of its business and technology peers.

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At Cylix, we make it our business to know a perfect match when we see one.

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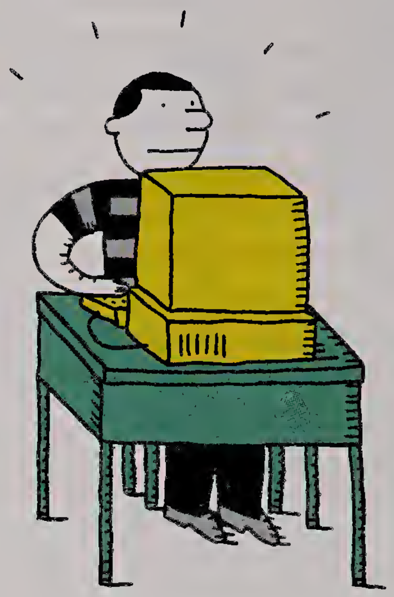
TRENDLINES

EDUCATION AND TECHNOLOGY

READING, WRITING AND RAM

Teachers in 14 Western states will be trading their blackboards for keyboards to demonstrate how information resources and technology can benefit the learning process.

The Technology for Teaching Project is a collaborative effort by three U.S. corporations and three education associations to promote the use of technology in meeting educational challenges. The US WEST Foundation is funding the project, which is also being supported by AT&T, IBM, the National Education Association, the American Association of School Librarians and the American Association of School Administrators.



One of the guiding principles behind TFTP is that technology is neutral, a means to an end. "The TFTP won't focus on technology itself, but on how educators can use technology to better prepare today's youth for life in the 21st century," said NEA President Keith Geiger. "Many educators have wonderful ideas that could help students learn—if only they had technologically advanced teaching tools."

Association partners and corporate sponsors will help faculty teams at 15 schools plan and conduct public demonstrations of high-tech solutions to educational challenges. Sponsors will also contribute funds, staff time and equipment.

Many of the projects involve linking classrooms with libraries, media centers or databases outside the community. Some of the more isolated schools have proposed using computers and teleconferencing to connect their homogeneous student bodies with students in other regions.

Students at a Tucson, Ariz., elementary school plan to use computers and filmmaking equipment to produce a record of the history of their community. A high school in Council Bluffs, Iowa, wants to use high-tech learning tools to improve students' understanding of science.

US WEST Communications President and CEO Gary Ames praised the project for involving its corporate sponsors on a personal level. "We didn't just dump dollars by the door," he said.

BUT UNLV WAS INELIGIBLE

Stanford University, of Palo Alto, Calif., captured the 1991 international collegiate computing crown in March, out-MIPSing Vrije University of the Netherlands, Virginia Tech and 19 other teams from the United States, Canada, Europe and the Pacific Rim.

The annual International Computing Challenge, which is sponsored by AT&T Computer Systems, gave entrants five hours to create a variety of programs solving such problems as how to route fire trucks around closed-off streets, how to draw up political districts and how to schedule surgery patients through busy operating and recovery rooms. The winning team used the fewest attempts to create the greatest number of viable solutions in the shortest time. AT&T awarded a total of $25,000 in scholarships to the six top-ranking schools. The top four schools received AT&T 6386/25 WorkGroup System computers.

AT&T sponsors the event to call attention to the growing shortage of qualified software developers. Recent years have brought a steady decline in the number of students enrolled in computer science programs and intending to pursue software development careers. "[T]he well . . . is alarmingly shallow," said one company official.

CALLING ALL CAR OWNERS

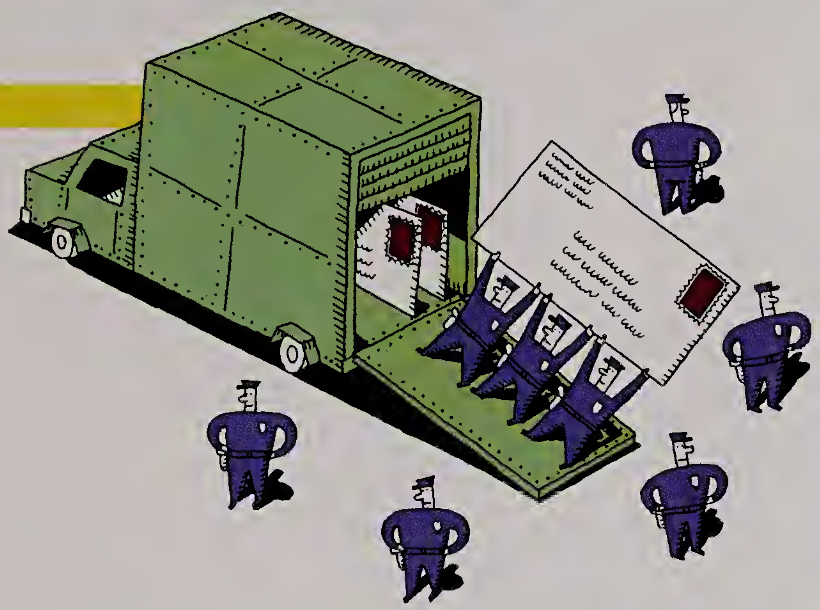
You may soon be able to put your car back on the road without getting out of your chair. Thanks to a new touch-tone vehicle registration renewal system developed for the Wisconsin Department of Transportation by PRC, the systems integration subsidiary of The Black & Decker Corp., residents can reregister their vehicles in less than three minutes by calling a 24-hour toll-free number. An automated voice at the PRC service center in McLean, Va., guides callers through the process (which includes entering the number of a major credit card); when the call is completed, the auto owner is automatically registered and sent new decals and registration confirmation through the mail. The company plans to add three more states to the system by the end of the year. It's getting so easy to do business from home, soon cars themselves will be obsolete.

ILLUSTRATION LEFT BY JAMES KACZMAN; RIGHT BY JULIA TALCOTT

TRENDLINES

E-MAIL SECURITY

EYES ON THE PRIES



Just because no one is going to hold your computer over a steaming kettle in order to open your E-mail doesn't mean your messages are safe. The Electronic Communications Privacy Act (ECPA) of 1986 was designed to provide electronic mail systems with the same kind of protection that is afforded to telephone calls. Now the Electronic Mail Association (EMA) has released a detailed explanation of that act.

Written by privacy experts John Podesta and Michael Sher, the guide examines how the ECPA protects E-mail both in transmission and in storage, rules against disclosure, and proper procedures for E-mail service providers who are asked to cooperate with law enforcement agencies. The act makes it a federal crime to intercept and disclose electronic messages, much like the wiretap statute prohibits the interception of telephone calls. While it protects all systems from interference by unauthorized users, the emphasis is on public service systems used by outside businesses, the general public or to forward messages.

Most E-mail systems are internal and not subject to the ECPA's disclosure rules. (The EMA guide does advise managers to inform workers of their rights and responsibilities with regard to the confidentiality of messages sent on internal systems.) But the number of public service E-mail firms has grown considerably over the past few years, and the law protects customers by allowing them to sue any such firm that discloses a message without authorization. The act also stipulates that law enforcement officials need a warrant, court order or subpoena to gain access to protected messages.

"The principles of ECPA are based in traditional American privacy standards," said Podesta, "but in order to fully comply with the spirit and letter of the act, electronic mail industry professionals should acquaint themselves with the law's specific provisions."

The guide is available from the EMA at a cost of $195. For more information call 703 522-7111.

THE GOOD, THE BAD, AND THE FIRED

Deloitte & Touche's third annual survey of CIOs' human resource concerns and challenges delivers what such studies often do: good news and bad news. The good news is that 62 percent of the 614 respondents—IS function heads of North American companies—participate in their organizations' strategic planning process; the bad news, of course, is that 38 percent still don't.

Reporting structure, another indicator of IS's organizational stature, showed mixed results. Thirty-five percent of 1990 respondents report to the CEO/COO level—a decline from 39 percent in 1989—but the reporting trend away from the CFO and toward the CEO continues.

More bad news: Retaining IS staff remains a challenge. Turnover among systems developers was up in most industries, due mainly to the availability of higher-paying jobs elsewhere and to termination as a result of poor performance. (The good news is that most respondents were optimistic that rates of staff retention would get better.)

CIOs themselves remain in jeopardy: 31.9 percent of respondents' predecessors were fired or demoted (up from 29.5 percent in 1989). Based on survey results, the industry for CIOs to avoid is distribution, where 60 percent report that their predecessors were fired or demoted.

THE WINDOWS-ICONS-MENUS-AND-POINTERS FACTOR

We don't know who minted it, but we came across the following acronymonious computer term in *Patricia Seybold's Office Computing Report* for February: "WIMP environments." As noted above, WIMP stands for windows, icons, menus and pointers, and the *Seybold Report* uses the term to generically describe computing environments that rely on graphical user interfaces.

Is there perhaps some degree of embedded scorn in this acronym? Is this the command-rich carping of manly DOS? Stay tuned.

DISTRIBUTED APPLICATIONS

MODEL MUDDLE

The age of full-fledged distributed applications may not be here, but a few academics are already trying to construct models and simulations for the new age of network processing.

Donald Saari, professor of mathematics, economics and applied mathematics at Northwestern University in Evanston, Ill., is trying to develop a mathematical model to define work spread out over a wide array of processors—and his search has taken him far afield from mathematics. In recent years, Saari has scrutinized multicandidate elections, complex organizations and the fate of commodities in a supply-side economy in an attempt to uncover models of distributed efficiency.

Designing cooperative algorithms for a network has "striking similarities" to the practical management of diverse tasks in a big corporation, said Saari. The main task of a distributed algorithm is to figure out what each proces-

ILLUSTRATION BY JAMES KACZMAN

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ansatlantic fiber optic cable completed. 1990 *Sprint announces the first commercial video services to the Soviet Union. Sprint introduces first nationwide ISDN capabilities.*

TRENDLINES

sor on the network should do, and then to determine which partially processed information should be passed along to which other processor. (Parallel processing is a similar conundrum.) Managers in a big shop need to assign different interrelated tasks to different departments. In fact, Saari believes that if he can construct a distributive formula, it will be applicable to a wide variety of information sciences.

Mathematical theories about the behavior of distributed information is one academic avenue; designing new ways to simulate distributed architectures is another. Wushow Chou, professor of computer science at North Carolina State University in Raleigh, and vice president of a network consulting firm, ACK Computer Applications Inc., points out that when distributed networks exist, planners will need to simulate the kinds of events these webs of processors might encounter, in order to get an idea, for example, if the pipes are big enough to handle different kinds of traffic scenarios.

Current simulation tools used by network designers won't be practical for previewing distributed computing environments, Chou argues. A one-minute simulation of a complex network will require humongous amounts of computer time, he said, "and you don't want to wait several days of running time to get an answer [to your simulation]." Chou said he is thinking about developing an alternative network simulation model for big networks. One possible solution: break up the simulation into parts, and extrapolate from the micro to the macro. ■

MY MOTHERBOARD, MYSELF

Just when you thought it was safe to go back into the self-help section at the bookstore, along comes a newly identified needy group—the dysfunctional systems development project team.

While the image of the antisocial, uncommunicative DP manager has become passé as companies align IT and business efforts more closely, IS professionals are generally untrained in group dynamics. For this reason, traditional systems development teams have a high chance of failure, writes Michael C. Kettelhut, a database design and research director for Humana Advanced Surgical Institutes, of Dallas, in the March 1991 issue of the *Journal of Systems Management.*

ILLUSTRATION BY JULIA TALCOTT

"Most IS development projects require group efforts in establishing system requirements [and] goals," said Kettelhut. "But because IS people are not usually educated in group dysfunction or organizational psychology, they may fail to recognize problems in their development groups that are sabotaging their projects. As a result, they experience extended development cycles and applications that . . . meet only a subset of original user requirements." Kettelhut advises team members to assess goals and commitments realistically, deal openly with personal conflicts and carefully discuss questionable issues or information. ■

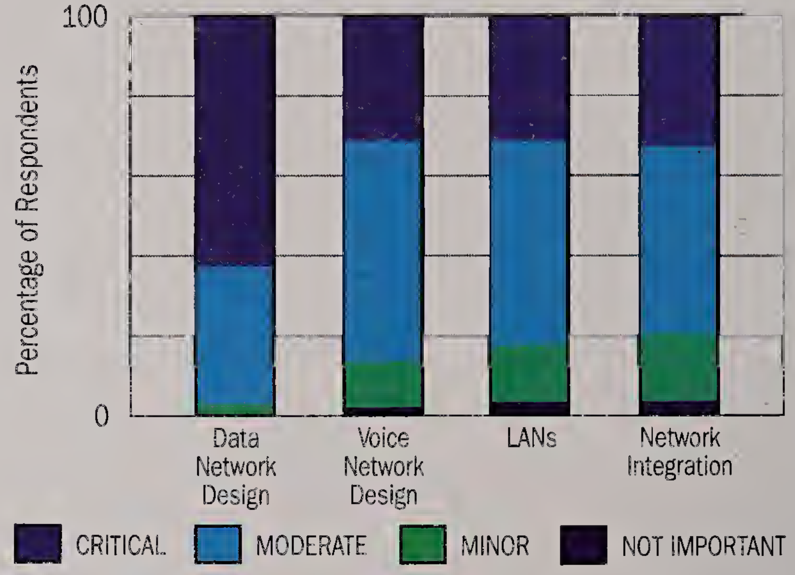
SURVEY STATISTICS

TRENDS IN TELECOMMUNICATIONS

According to a survey of companies with average annual revenues of $420 million, telecom budgets of $7.6 million, and 11 full-time telecom employees, network design, planning and management are the most important areas in telecommunications. ■

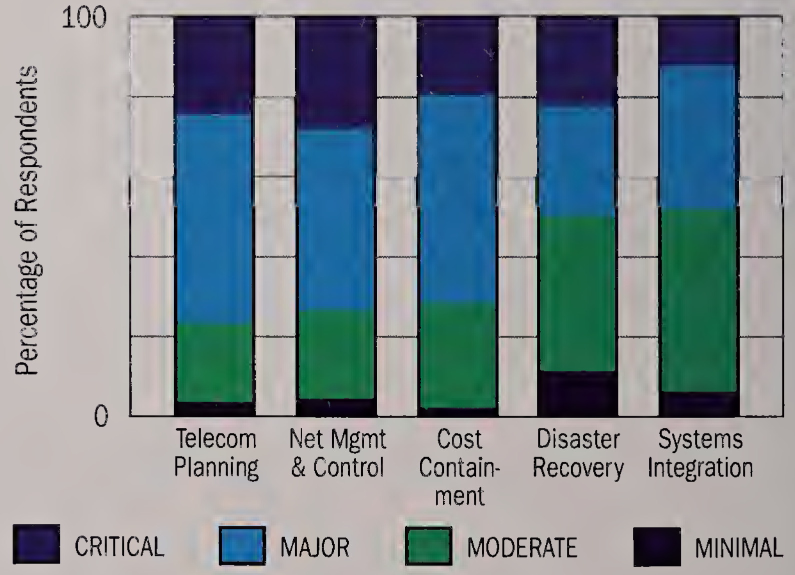
Technical Issues

Data network design was cited as the most important technical issue.



Management Issues

Network planning is the most crucial telecommunications management issue facing companies today, with network management and control a close second.



Source: Deloitte & Touche's *1990 Annual Survey of North American Telecommunications Issues.*

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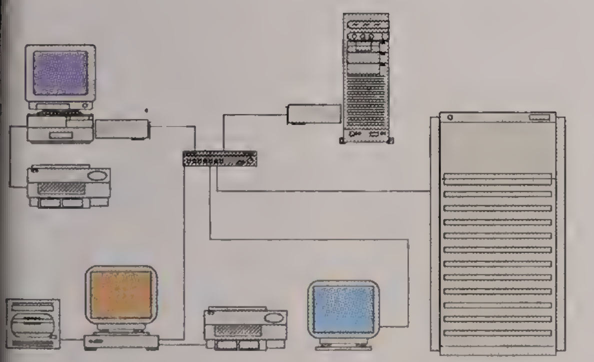

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CIO PERSPECTIVES

MAXIMIZING PROFITS THROUGH IT

It's remarkable how a beautiful locale, some R&R and interesting company can help executives take a fresh look at thorny problems. Amidst the sea pines and Spanish moss of Florida's Amelia Island resort, attendees of the March 1991 CIO Perspectives conference sought new insights into maximizing profits through information technology.

Alan R. Fusfeld, president and CEO of Generics North America, introduced the conference topics: getting the most out of the IT investment, measuring the gain achieved through IT, aligning technology with critical success factors and "rightsizing" the IT infrastructure and function.

John J. Donovan, president and CEO of the Cambridge Technology Group, picked up the gauntlet with a rousing speech: "There are lots of business opportunities in the '90s, but many organizations can't manage the old opportunities they already have." His solution: Don't outsource the strategic applications that give you a competitive edge. Instead, move up to the technology of the 1990s and run those applications on a multivendor, open systems-based client/server platform.

Measuring the ROI of IT is necessary for maximizing profits, yet it's one of the IS profession's enduring bugbears. Speaking via satellite from London, Paul A. Strassmann, author of *The Business Value of Computers*, argued that the correct way to measure the return on IT is to evaluate the future productivity gains it brings to the entire business. He went on to outline his framework for measuring those gains—an approach that considers not only the cost and strategic advantages of IT, but also how IT affects the productivity of the management process. Top corporate executives still lack hard data on the benefits of IT, and this is often the reason IS executives are left out of the corporate decision-making process, Strassmann said. "If you want to be invited to the party, you'd better be an attractive guest."

The conference also offered panels where CIOs could show how they are getting the biggest bang for their IT buck. Wal-Mart's senior vice president of corporate information systems, Bob L. Martin, described how his company became America's largest retailer by using IT to lower costs, better understand customer preferences and buying patterns, and pursue a localized merchandising strategy. A panel on rightsizing put the downsizing phenomenon into an appropriate business perspective. At Continental Bank in Chicago, according to CIO John Gigerich, "rightsizing was the result of our process, not an action." Gigerich described how a radically new IT architecture enabled the once troubled bank to pursue new business strategy. Sun Refining & Marketing Co.'s IS director, John J. Donohue, discussed how his company saved millions by outsourcing its data center operations and distributing IS functions into the business units. Rightsizing not only saved money, Donohue found, but it led to a "more assertive, less risk-adverse" IS staff.

The next CIO Perspectives conference, to be held in Monterey, Calif., Sept. 22 through 25, will pick up the theme of people, productivity and profits.

JOHN J. DONOVAN *(left) warns against outsourcing strategic applications.* **PAUL A. STRASSMANN** *(bottom left), via satellite from London, urges businesses to measure ROI based on future productivity gains.* **RAYMOND E. CAIRNS, W.R. MEFFORD** *and* **ALAN R. FUSFELD** *(above, l.-r.) discuss their presentations.*

PHOTOGRAPHY BY DAVID BURGHARDT/ISLAND PHOTOGRAPHY

NOMINATIONS WANTED

Digital Equipment Corp. and *Chain Store Age Executive*, a monthly magazine that covers the retail industry, are soliciting nominations for their jointly sponsored 1991 Retail Innovation Technology Award (RITA). The RITA goes to the retailing company judged to be most innovative in its business use of information technology. Three honorees (a winner and two runners-up) will be chosen by a panel of judges including representatives of last year's winning companies, Sears, K mart and Fortunoff. The award will be announced in October at the Retail Information Systems Conference in Chicago.

Entries, which must be postmarked by June 1, should be sent to RITA, c/o *Chain Store Age Executive*, 425 Park Ave., New York, N.Y. 10022.

EXECUTIVE ACHIEVEMENT

Donald R. Beall, chairman and CEO of Rockwell International Corp. in El Segundo, Calif., is the winner of the Gartner Group's Excellence in Technology Award. The annual award, established by the Stamford, Conn.-based consulting and market research firm, acknowledges the recipient's achievements as a leader in managing and employing IT.

Beall, who was selected by a panel of 10 CIOs, was lauded for promoting his company's use of IT to improve quality and to better its relationship with customers and suppliers. Under Beall's direction, Rockwell implemented a global supplier database and an extensive EDI network.

Past winners include David T. Kearns, CEO of Xerox Corp.; Frederick Smith, CEO of Federal Express Corp.; and Robert Crandall, CEO of American Airlines Inc.

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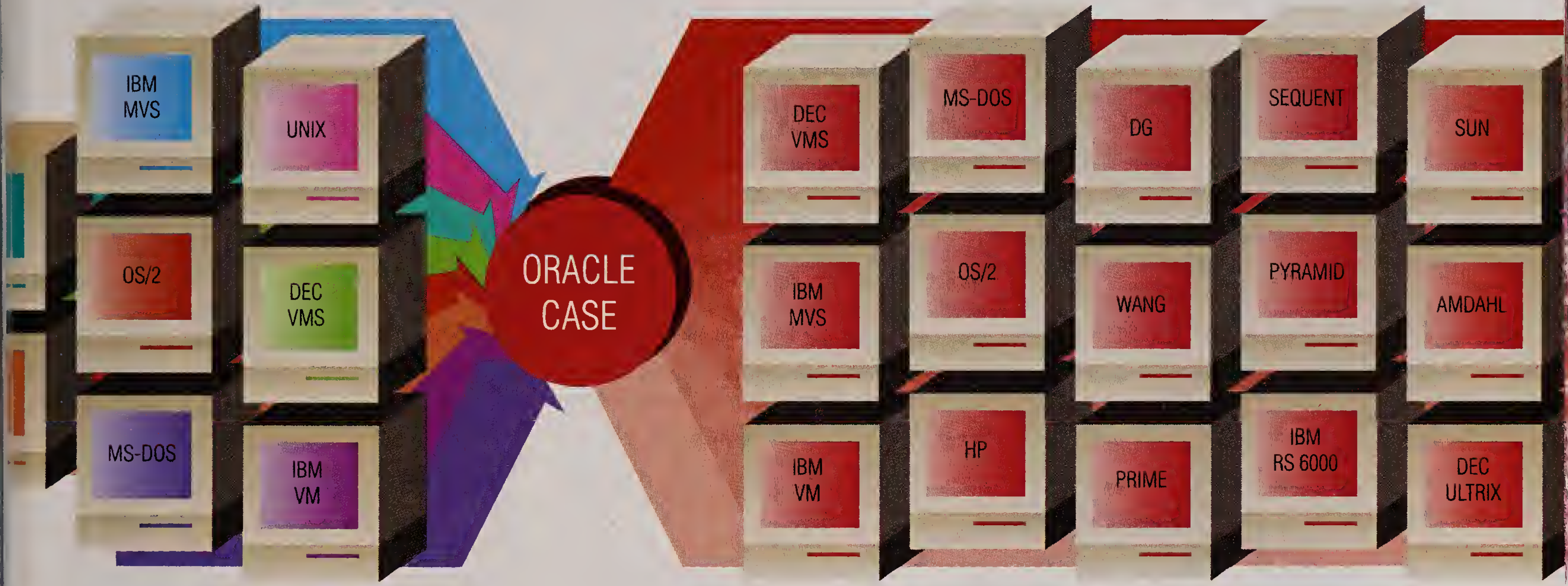

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Getting the Message

When used to its full potential, voice mail can be a powerful and versatile tool for increasing productivity and achieving competitive advantage

BY GUS BENDER

Voice mail is the most important productivity tool since the photocopier. When used properly it can increase a corporation's productivity by 30 percent, and improve customer service by allowing faster communication. Voice mail, often called voice messaging, can also help decrease layers of management, built up for the purpose of disseminating information, by broadening span of control and speeding up decision-making.

Voice mail, stated simply, allows people to talk to people. Personal messages are created, addressed and sent via a touch-tone telephone. A message can be sent to multiple recipients simultaneously, using distribution lists. Users can receive, reply to and redirect messages, as well as place verbal comments in front of messages before redirecting them.

ILLUSTRATION BY FRAN O'NEILL

The key to maximizing the potential of voice mail is recognizing that dialing direct is often a waste of time. The telephone call is an essentially inefficient operation: According to a survey of employees at Travelers Corp. in Hartford, Conn., 60 percent of all calls involve transactions that can be completed without a two-way conversation. In addition, 75 percent do not reach the person to whom they are directed (25 percent receive a busy signal, 35 percent are answered by another party, and 15 percent are not answered at all). Then of course there are the frustrations of being put on hold, or talking to untrained, uninformed, unconcerned individuals who are covering the telephone. Not to mention the 90 percent probability that the messages such people take will contain errors or misinterpretations.

It is far more efficient simply to use the voice mail system. Voice messaging allows information to get to the recipient quickly, clearly, accurately and with the nuances of voice inflection intact (not possible with E-mail). Voice mail users avoid playing telephone tag, and users on different coasts can exchange messages without worrying about the time difference. In addition, the same message can be sent to many people, eliminating the need for multiple telephone calls.

The use of voice mail increases the ability to contact others by 20 to 30 percent. Faster, more immediate communication means work can be accomplished more quickly. Decisions get made faster, problems are solved with greater dispatch, and customer service improves.

Although voice mail users can save time and reduce frustration, they must be careful not to abuse this valuable tool. When voice mail is implemented solely for the purpose of answering telephone calls (call coverage), employees are frequently perceived as hiding behind the system. This can produce a number of negative results. Customers may become dissatisfied when they cannot reach individuals. Unhappy executives who cannot talk directly with staff can develop a negative attitude toward voice processing; this may adversely impact their corporation's ability to successfully implement other forms of voice processing technology. Such abuse may even result in removal of the voice messaging system.

But this can be avoided. When voice mail is being used for call coverage, the caller should be invited to press "0" to reach a secretary or given a number to call for personal assistance.

Corporations that want to harness the power of voice messaging must prepare the way by making changes in the corporate culture. Workers must learn to consider voice messaging as a form of communication equal or superior to the telephone call, face-to-face meetings, memos/letters or E-mail. Changing employees' attitudes in this way is not easy, and upper management must show patience and support if it hopes to ensure a successful transition. The best way upper management can show support for voice messaging is by using it; employees will almost certainly follow their bosses' example.

Once some departments begin to experience the power of voice messaging, others will quickly follow. Voice messaging will gain momentum like a train picking up speed as it travels down a hill. The more people that can be contacted through its use, the more valuable and effective voice messaging becomes. This is the same phenomenon that made the telephone a powerful business tool.

If voice mail is to achieve its full potential, primary suppliers (those with whom a corporation has frequent contact) should be added to the system. Clarification of product details, contract questions, delivery issues, meeting schedules and service questions can all be communicated through voice messaging. One large corporation requires all its primary suppliers to use its voice mail. Any supplier not on the system is not considered an active supplier. Needless to say, suppliers seek to be put on this corporation's voice messaging system.

Corporations can also achieve competitive advantage by placing customers on their voice messaging system. The elimination of telephone tag will improve response time and customer service, which will be perceived as added value. Customer issues will take less time to resolve, so productivity will improve. Using voice messaging, numerous employees can become quickly involved with a customer service problem, increasing the power of the customer service organization.

Networking isolated systems together can also increase the effectiveness of voice messaging. (Additional hardware and lines may have to be added to achieve networking.) Locations with voice messaging systems from the same supplier are the easiest to connect. Depending on the vendor and model, networking can be in an analog or digital mode. Digital is preferable for several reasons: It is often faster than analog and provides superior signaling characteristics. It also eliminates digital-analog-digital conversions and offers more features and functions than analog.

The key to maximizing the potential of voice mail is recognizing that dialing direct is often a waste of time.

Networking many systems requires management/administration similar to the management of data systems or multiple PBXs. The corporation must investigate the diagnostics, networking reports and alarms available for its systems and determine the level of networking support required. Because networking requires special expertise, appropriate staff should be provided to manage the voice messaging function. This staff, at a minimum, must have influence over remote site management. Better yet, all voice message administration and network management should be centralized, as the network demands compatible software levels, hardware vintages and networking schedules as well as coordinated database and voice fragment administration.

Networking voice mail systems from different vendors is more complicated and will not be possible until vendors build into their products the Audio Messaging Interchange Specification (AMIS). Already published, the analog and digital versions of this specification are being incorporated into the products of most voice mail vendors, who should be ready to provide the analog version this year.

Before purchasing a voice messaging system, the buyer should ask the vendors being considered when AMIS networking will be available and at what cost, and include a requirement for AMIS analog and digital intervendor networking in every voice messaging RFP.*

The potential of voice messaging is vast. As more people acquire voice systems for business and personal use, and as these systems are networked together, the true power of voice messaging will be unleashed. But the spread of networked systems is not sufficient to achieve this goal. A new industry must be born, closely aligned with voice messaging and electronic mail: an industry of directory services allowing systems to easily find and direct messages to recipients. Much like the X.500 in electronic mail, voice messaging directory services would locate the message recipient's home system and automatically deliver the message without the sender knowing the specific address.

Corporations should strive to harness the power of both island and network voice messaging systems and position themselves to increase the technology's value by using it to communicate with suppliers and customers. Prescient corporations will also prepare themselves to adopt voice messaging directory services. When implemented correctly, voice messaging can be one of the most productive of business tools. CIO

* *To obtain a copy of the AMIS voice mail intervendor networking specification, contact James Burch, Hatfield Associates, 4840 Riverbend Road, Boulder, Colo. 80301. Phone: 303 442-5395. Fax: 303 442-9125.*

Gus Bender is second vice president of telecommunications at Travelers Corp. in Hartford, Conn.

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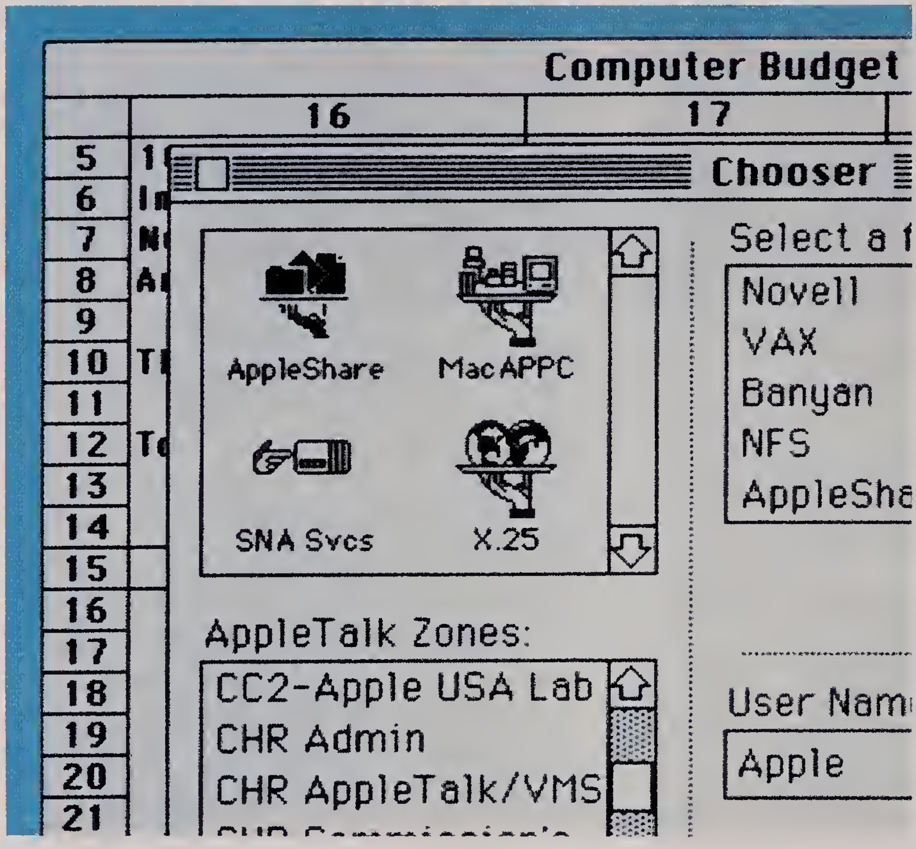

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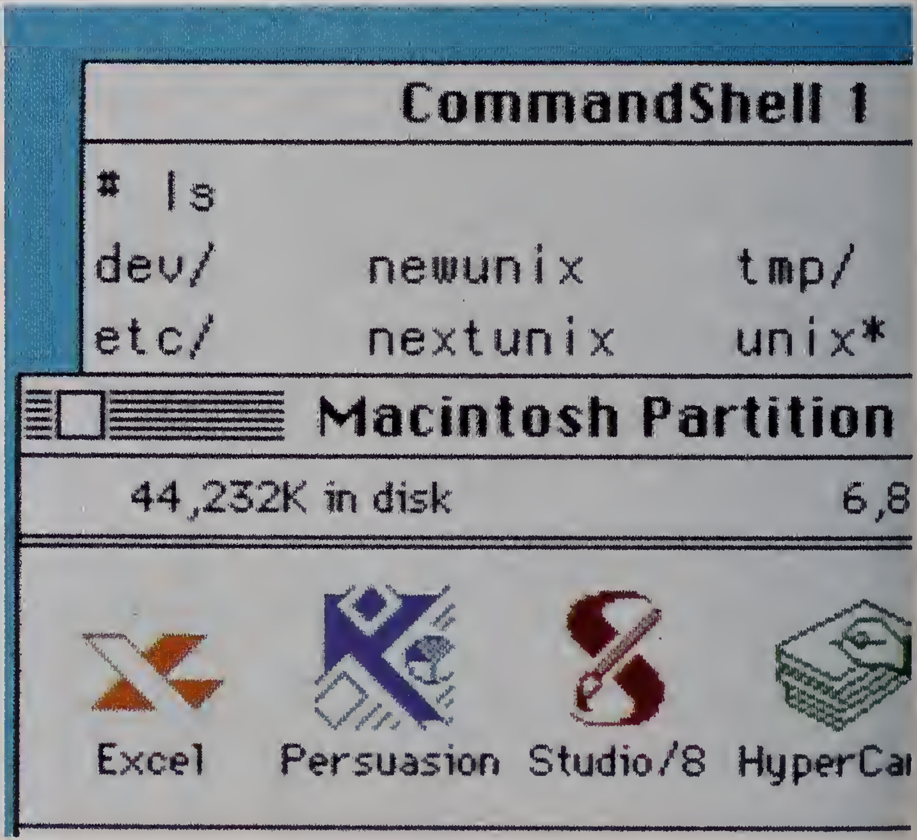

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While diversity may make life rich and fascinating, it makes life as an IS manager something short of serene.

What is politely referred to as the "multi-vendor environment" is an amalgam of disparate hardware, incompatible operating systems, dissimilar databases, and multiple networks. Nevertheless, IS people are expected to make these all work together in perfect harmony.

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Up-and-Comers

Industry participants and observers assess the year in communications

BY MEGAN SANTOSUS

What's new in communications? According to six respondents representing the vendor, consulting and user communities, the most significant developments emerging over the past 12 months are frame relay, virtual private networks, LAN internetworking and personal communications services (for more-detailed explanations of terms, see the reference section, Page 95). A few established technologies, such as videoconferencing and radio, show signs of finally coming into their own.

Les Sitzes

Director of the communications information group at Datapro Research in Delran, N.J.

A big development is LAN internetworking and interoperability. Not that any of this is new per se, but it's now a very dynamic and complex market. Issues arise in integrating various devices in the LANs and then connecting them to other LANs.

In conjunction with LAN internetworking is network management. Control of the links and the various other things in a network is what's needed. Integrating LAN management with WAN management will lead to a facilities function at a single site. Right now we have separate network management systems for LANs, facilities, services, multiplexors, T1 and modem. Integrating all these elements will provide a complete view of the network.

Another area is superservers—computers, specifically minicomputers, designed as servers. They have input/output ability, and they can run on the same standard operating system as LANs. These superservers can streamline operations and make it easier to interconnect various devices in a network.

EDI has been around for 20 years, but it's starting to take hold now. Mid- to large-sized companies will definitely see savings by streamlining their business processes. Larger companies are now mandating that their smaller trading partners implement EDI, which was first used in the transportation industries but is now beginning to spill over to others.

The cellular industry, specifically the area of personal communications services, will be big. Portable CTU technology based on various standards really blossomed in 1990. Eventually this will lead to an untethered society, where we'll have personal numbers and it won't matter if we're at home or on a business trip.

Outsourcing is a bit of a surprise. Ten years ago companies built private networks because they wanted complete control. Now we've done a complete cycle—companies are looking at what can be outsourced while still maintaining control of basic management responsibilities. Managing

ILLUSTRATION BY KEVIN HAWKES

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data centers is not what a company wants to do unless it happens to be in the computer and networking/communications industry.

Peter G. W. Keen

Executive director of the International Center for Information Technologies in Washington

The number-one development without a doubt is frame relay—it will transform life as we know it. Frame relay works within an X.25 architecture, so there's no need to redesign, rebuild or repurchase anything. It takes out the built-in delays of an X.25 environment, resulting in speeding up networks by a factor of at least 10. This will create an opportunity for a variety of applications and will have a particularly big impact on image processing. Cell relay is very fast packet switching, even faster than frame relay, but it's still under development.

End-to-end network management is being recognized as the key to the game. Network management is not a simple issue of managing devices—it's managing business services and issues.

The client/server model and cooperative processing in a distributed computing environment is the way to go. The client and server share facilities and services—it's a complex architecture, but there is far more processing performance. People are beginning to recognize that we're in the networking business and you fit your computing in, rather than the other way around.

The gambles are more dangerous than ever before. You've got to make key bets now on the standards and technologies you think will be the key ones in the future. Nobody really knows which ones will be around for the long haul. Look at ISDN—it's now so obsolete that it's not even worth thinking about. But there are a heck of a lot more choices to make now, which means that the future of communications is very complex.

David L. Passmore

Partner of the Ernst & Young Center for Information Technology and Strategy in Fairfax, Va.

People are moving to networks that are essentially linked LANs. This has led to an interest in new technologies such as frame relay, which is a more efficient replacement for X.25 because it is ideally suited for the high-speed and bursty traffic on LANs.

There's an incredible interest in customers building their networks with multiprotocol routers. Compared to bridges, routers provide far more sophisticated operation at level three of the OSI model by minimizing overhead traffic, providing efficient routing and making it easier to separate the network into different administrative or management domains. Thus, people can make changes to one part of the network without a ripple effect.

> *"The number-one development without a doubt is frame relay—it will transform life as we know it."*
>
> *–Peter G.W. Keen*

Another advantage supporting multiprotocol stacks is that they are ideal for mixed-vendor environments. They don't force people to give up what they have in terms of software.

There's also a trend to shed voice traffic from private T1 backbone networks and instead use virtual private network services from carriers such as MCI, US Sprint or AT&T. Moving voice off the networks entirely is cheaper because it's circuit-switched. This greatly reduces the amount of management attention required, because the carrier can maintain it. We may see the same movement regarding data to SMDSs [Switched Multimegabit Data Services] offered by local exchange carriers.

Organizations are increasingly interested in integrating their network management systems. I call the current mode of operation swivel chair network management, because there are multiple consoles, each of which provides access to a single vendor's system. Consequently [when there is a failure], the network operator has to formulate several different possibilities in order to answer the question, "What went wrong?" Not only is it hard to find people who are trained in all these network technologies, but it gets harder when trying to optimize or tune the parameters of the network.

Additional key trends are LAN internetworking, LAN management and outsourcing. In a very basic sense, moving to virtual private networks is a form of outsourcing that has really accelerated in the past year. There are a lot of multinational companies that would love to do this for their international networks, but this service is not widely available yet. Over time you'll see the major carriers start their own virtual private network services internationally because companies don't want to deal with foreign PTTs themselves.

Robert W. Stearns

Vice president of corporate marketing for the Codex Corp. in Mansfield, Mass.

There's a big focus on frame relay and fast packet, which are both very important for voice and data networks. Frame relay will increase speed and reduce cost. It also enables networks to mix different kinds of traffic and equipment and exchange information between carriers.

Frame relay, which is really a replacement for the X.25, is increasingly being adopted. Frame relay and fast packet are not to be confused—frame relay is a good access method to a fast packet backbone network. It isn't simple to implement, but the

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benefits greatly outweigh the problems.

Internetworking using remote bridges and routers is another significant development. These technologies will enable communications between LANs and WANs. A remote bridge is a level-two OSI device that extends from LAN A to LAN B without doing any conversion or routing. A router is a more complex device—it "looks" at the traffic and the protocol and routes it. Bridges are somewhat faster and somewhat lower-cost, but both will be used.

Private networks are in the business of network management and will play a major role in managing all of the assets known as bandwidth. Hybrid networking for data—which depends on operating environments, protocols and equipment—consists of both private and public networks, while virtual private networks will be used for voice, which is much more standardized.

Videoconferencing has finally hit its stride, and it will become a standard tool for corporate communications. Prices are very reasonable now, and video will replace audio-only conferences.

The biggest flash in the pan is ISDN—where is it now? This is because the RBOCs have a difficult time cooperating with each other and marketing anything new. The problems with ISDN illustrate the real issue—RBOCs should stick to basic services rather than try to offer sophisticated technologies.

John Coman

Manager of networks and information services at ARCO in Los Angeles

I don't think there's anything all that new; it's really new shades of what's been going on for a long time. The most interesting development here at ARCO is a result of software being integrated into telecommunications.

We are using a sophisticated 900 MHz trunked radio network that was initially developed for disaster recovery, but we will evolve it to use in all our business functions. We are changing most of our radios over to this system, which gives us bandwidth and a frequency that is ours alone so we can do with it what we want.

The advantage of the new radio system is that we have our own channels, and it's non-competitive. It provides us with a lot more security and privacy, although I don't necessarily see it as improving speed.

The integration of software technology into radio communications has allowed us to do some sophisticated things. We now have the ability to separate radio calls into priorities and to bring people on and take them off the system.

> *"Videoconferencing has finally hit its stride, and it will become a standard tool for corporate communications. Prices are very reasonable now, and video will replace audio-only conferences."*
>
> *–Robert W. Stearns*

The communications technology that's affecting everybody is cellular phones. Again, this technology is not new, but it's really catching on right now.

The biggest problem I see is an international one. If you take a small country where the most profitable state industry is the PTT, that country is not going to let you build and operate your own communications network. So the biggest problem is politics, not technology—the technology is there.

Phil Wilkinson

Strategic marketing vice president at AT&T Network Systems in Morristown, N.J.

Both narrow and broadband videoconferencing have really taken off. AT&T has developed a prototype video on ISDN with a speed of 64 kilobits. This creates video that is almost television quality. We have a product for 1992 using video compression techniques enabling video right on a PC screen. There are a whole range of appliances that will really drive ISDN into the home and make it affordable, such as an external telephone hookup with a camera and a microphone—just add a board and you're ready to go. These appliances will enhance ISDN to businesses that have it and introduce it to consumers.

We are combining video compression with the same technology as ATMs so users can communicate while actually seeing their banker. The idea is not to replace the ATM hardware that's already there, although some components may have to be added to existing ATMs. We currently have a sophisticated prototype with a bank, and a product will be ready by 1992.

The other things that are significant are optical computing and optical switching. We plan to have an optical switch fabric in less than five years that will allow cross-connects to be switched optically. This will improve capacity, efficiency and speed by at least three orders of magnitude. To make an analogy, what we now have is a horse and buggy, and what I'm talking about is the space shuttle. The broadband services will be able to handle a trillion bits per second. That kind of bandwidth will be capable of switching 20,000 simultaneous television channels, and video will be as economical as voice.

Another major trend I see is the personal communications networks and services where an individual has a single telephone number that goes with him anywhere. It's important because we're moving into the wireless cellular networks area. Individuals will be in control and have much greater access to information.

The biggest problem is building network platforms and getting services out there faster. CIO

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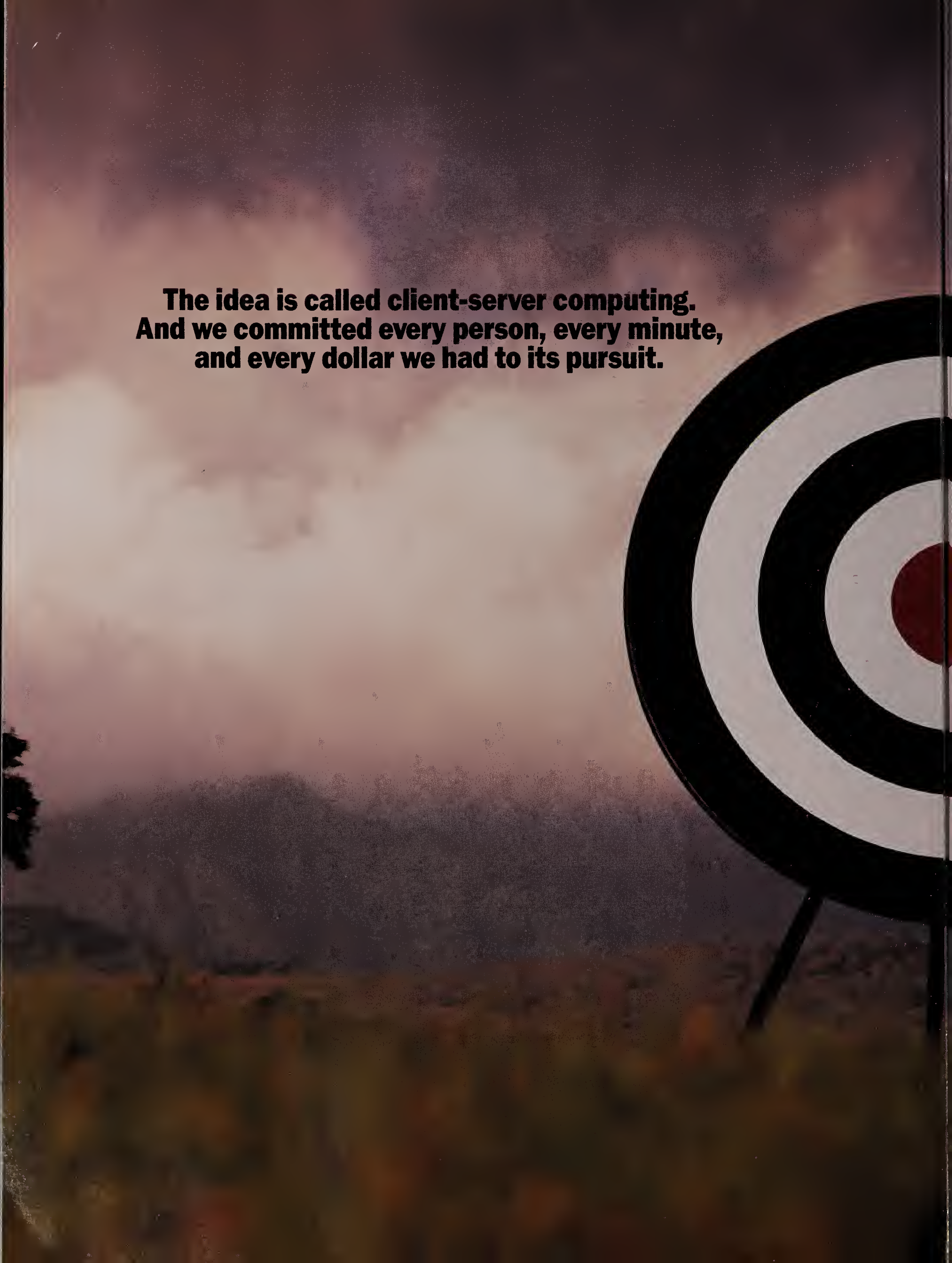
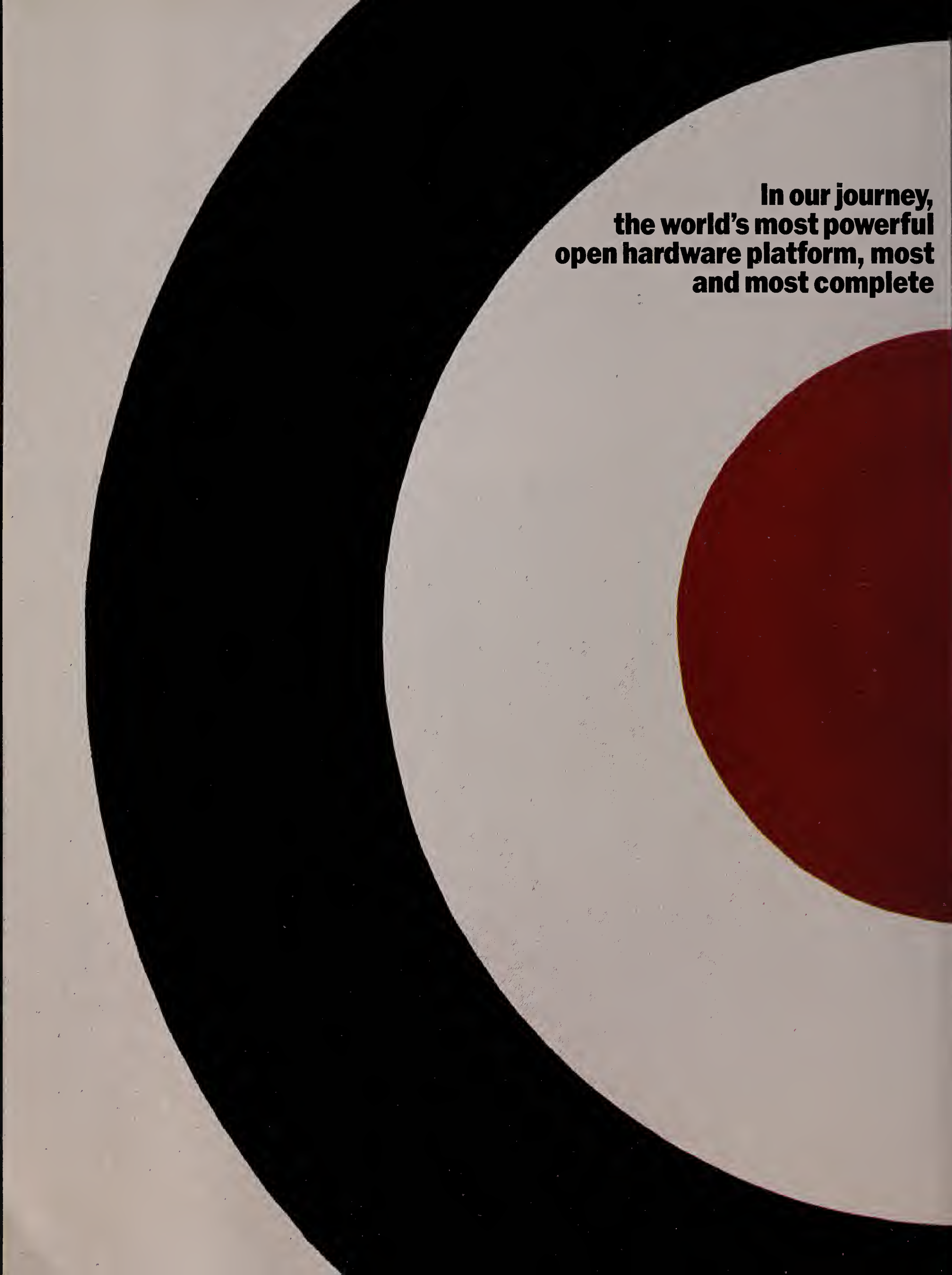
one computer company set its sights on
a radical new idea in computing.



**The idea is called client-server computing.
And we committed every person, every minute,
and every dollar we had to its pursuit.**



In our journey,
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open hardware platform, most
and most complete

we discovered
operating system, most
flexible network architecture,
graphical interface.

360,000 systems later, it can

Any time a computer company designs for the future, there's a very good chance it will miss the mark.

If the new technology it creates is too similar to what's already available, businesses have little reason to adopt it. If it's so radically different that existing computers are rendered useless, businesses won't even consider it.

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First, Sun approached client-server computing with a clean slate. We had no old, proprietary technologies of our own to "fit in." That left us free to explore promising new concepts such as RISC processing, object management, and digital imaging.

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And third, we approached the whole subject of client-server computing a little differently than other vendors:

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2) We build everything into our systems that's needed for true client-server computing (RISC processing, multitask-

safely be said that our aim was true.

ing, Ethernet, e-mail, audio, a graphical user interface, and plenty of memory and storage).

3) We give you a simple, consistent way to work within applications, access files, print, send mail, and manage network resources.

4) We offload processing from host computers to servers and workstations — your system can grow without limits, and in less costly increments.

5) We integrate all of your company's computers, so you can draw upon the data, applications, and processing power of every computing resource on the network.

Different, perhaps. But is Sun's approach better?

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Sharing The Wealth

Distributed computing enables organizations to link all their information resources and the people who use them. But getting there is no simple task.

> *"Nature and*
> *Nature's laws*
> *lay hid in night:*
> *God said,*
> *Let Newton be!*
> *and all was light."*
>
> *—Alexander Pope,*
> *18th century*
> *English poet*

Sir Isaac Newton was an ill-tempered, jealous man who lacked the good sense to get out from under a falling apple. But to the Western world at the dawn of the scientific era, he was the shining symbol of Reason Triumphant, proof that mankind possessed the ability to find order in a previously unfathomable universe.

IS professionals—in fact, any executive in a fair-sized computer-dependent company or organization—could use a Newton to show the way. Today we are leaving behind the age of centralized, mainframe computing and entering an age of distributed computing where intelligence can reside in many points in the network. Many companies are taking this path: About 76 percent of IS executives at 110 companies we surveyed said they have implemented distributed computing or are planning to do so soon.

Most of these CIOs aren't having an easy time. The laws of this new era still lay hid in night. Old technologies, old computing standards and rules, and old work habits are passing on, but it is not clear what new technologies, standards and methods will replace them and which old ones will survive. The phrase "distributed computing" itself is not so much a buzzword as a lint ball: an amorphous collection of fuzzily defined terms, concepts and computing architectures, in-

LOGO BY MARK FISHER

cluding PC-to-host, peer-to-peer, client/server, cooperative processing, coherent computing and integrated network computing.

Last year in our May issue, *CIO* sought to identify the questions CIOs must ask and the issues they must consider to build and manage successful communications systems and organizations. This year we have set out with the same aim, but focused specifically on this important, networking-dependent approach to computing.

The phrase "distributed computing" itself is not so much a buzzword as a lint ball: an amorphous collection of fuzzily defined terms, concepts and computing architectures, including PC-to-host, peer-to-peer, client/server, cooperative processing, coherent computing and integrated network computing.

The logical place to begin is with the most basic question: What is distributed computing good for anyway? Much has been written about the technical advantages (lower cost per MIPS, downsizing, etc.), but little about the business advantages and disadvantages. Tom Kiely's article analyzes the options that fall under the distributed computing rubric, and the advantages and disadvantages of each. Meghan O'Leary picks up the thread by writing about the industries, businesses and organizational functions where distributed computing has paid off—and where it has been found lacking.

CIOs told us that managing LANs and making sense of networking standards are two of the biggest headaches in distributed computing. In her article, Leslie Goff examines such issues as LAN troubleshooting off wide area networks and sharing control with users. The interviews on networking standards are full of debate over which standards to select and how to choose them. As always, human factors are at least as important as technical issues in bringing a new technology to life. How distributed computing affects the relationship between IS and its internal customers is the focus of Paul Konstadt's article.

One of the most popular features of last year's special issue on networking and communications was the reference guide, prepared with the invaluable guidance of Datapro Research, covering standards and standard-setting organizations, terminology,

Distributed Computing: The Nature of the Beast

Understanding What It Is and What It Isn't

A distributed computing environment is characterized by multiple hardware platforms (such as PCs, minis, mainframes) networked across organizational functions and capable of sharing data, applications and processing burdens.

It does not consist solely of standalone local area networks, or networks consisting of a mainframe and dumb terminals.

A distributed computing environment does not necessarily have the corporatewide coverage, seamless integration and common graphical user interface that characterize the nascent cooperative-processing architecture.

PHOTO BY RALPH MERCER

CIO Survey on Distributed Computing

As in our March issue on software development, we conducted a telephone survey in order to better understand our readers' views on distributed computing. We contacted 110 information executives to learn the degree to which organizations are practicing distributed computing, its benefits and difficulties, and the major LAN management issues affecting CIOs, among other things. All the companies we polled have over $500 million in annual revenues.

Our findings appear throughout the magazine, accompanying related articles. Thanks go to Megan Santosus for helping to conceptualize the survey, to Sue Sudan, Sheila Robbins and Molly Upton for conducting it, and to Mina Ahn for compiling the results.

Index to the 1991 CIO Distributed Computing Survey Results*

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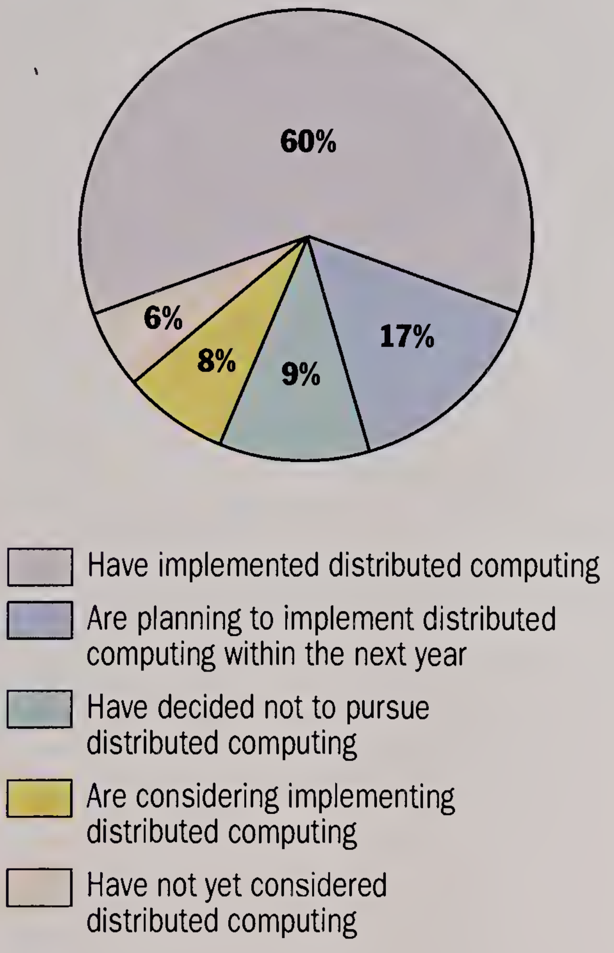
**Page numbers refer to the first page of the article in which the chart appears.*

educational programs, public networks and more. We're pleased that Datapro has helped us update this section for this issue.

This month's columns and departments cover other communications and networking issues. Megan Santosus's "Outlook" column reveals the most significant new communications services and trends of the past 12 months; Scott Wallace examines wireless networks in our "State of the Art" department, and in "Insights," Gus Bender, a Travelers telecommunications executive, shows how to use voice mail to its fullest potential. "Conference Call" asks telecommunications managers to reveal what CIOs need to know about the telecom field but often don't.

CIO DISTRIBUTED COMPUTING SURVEY

Breakdown of Companies Surveyed



"If I have seen further [than other mathematicians and logicians] . . . it is by standing upon the shoulders of Giants," Newton wrote in a letter. As with Newton, so with us: We wish to thank the many IS executives and industry experts who helped make this issue possible.

–A.E. Alter

Making the leap is a lot less intimidating wh

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LOOKING AT THE OPTIONS

The Distributed Melting Pot

The term distributed computing has become a crucible for network architectures ranging from rudimentary distributed databases to sophisticated cooperative processing

BY THOMAS KIELY

This is distributed computing: a new-age, new-wave enterprisewide network, supporting intelligent applications that are interlaced like family histories in a small town—applications that will cooperate with each other, communicate with each other, support each other. Data and processing tasks will be distributed to multiple processors, made by multiple vendors, supporting multiple standards. And all of this will appear to be local, and it will be easy to the end user as well as lightning fast. But distributed computing is also the work done by a couple of workstations plugged into an old mainframe. It is LANs hitched to WANs, peers to peers and clients to servers.

Plato defined man as a "two-legged animal without feathers," a description that Diogenes proved woefully inadequate by plucking a cock and presenting it at the Academy as "Plato's man." As a tag, distributed computing isn't quite so broad: *CIO* has recast the term to exclude featherless fowl, stand-alone LANs and intelligent terminals struck dumb by mainframe emulation programs—what Mark Teflian, president of Covia Technologies Inc., in Rosemont, Ill., refers to as "reducing two machines to their lowest common denominator." But discussions about distributed computing often lose their way in the particulars and variations. What some call cooperative processing (that starry-eyed future of distributed hardware, communications and applications), others refer to as coherent computing, or integrated network computing. A few CIOs consider distributed computing a synonym for client/server architectures; for others, it refers to peer-to-peer architectures.

The confusion arises from the nature of the technology itself. Distributed computing

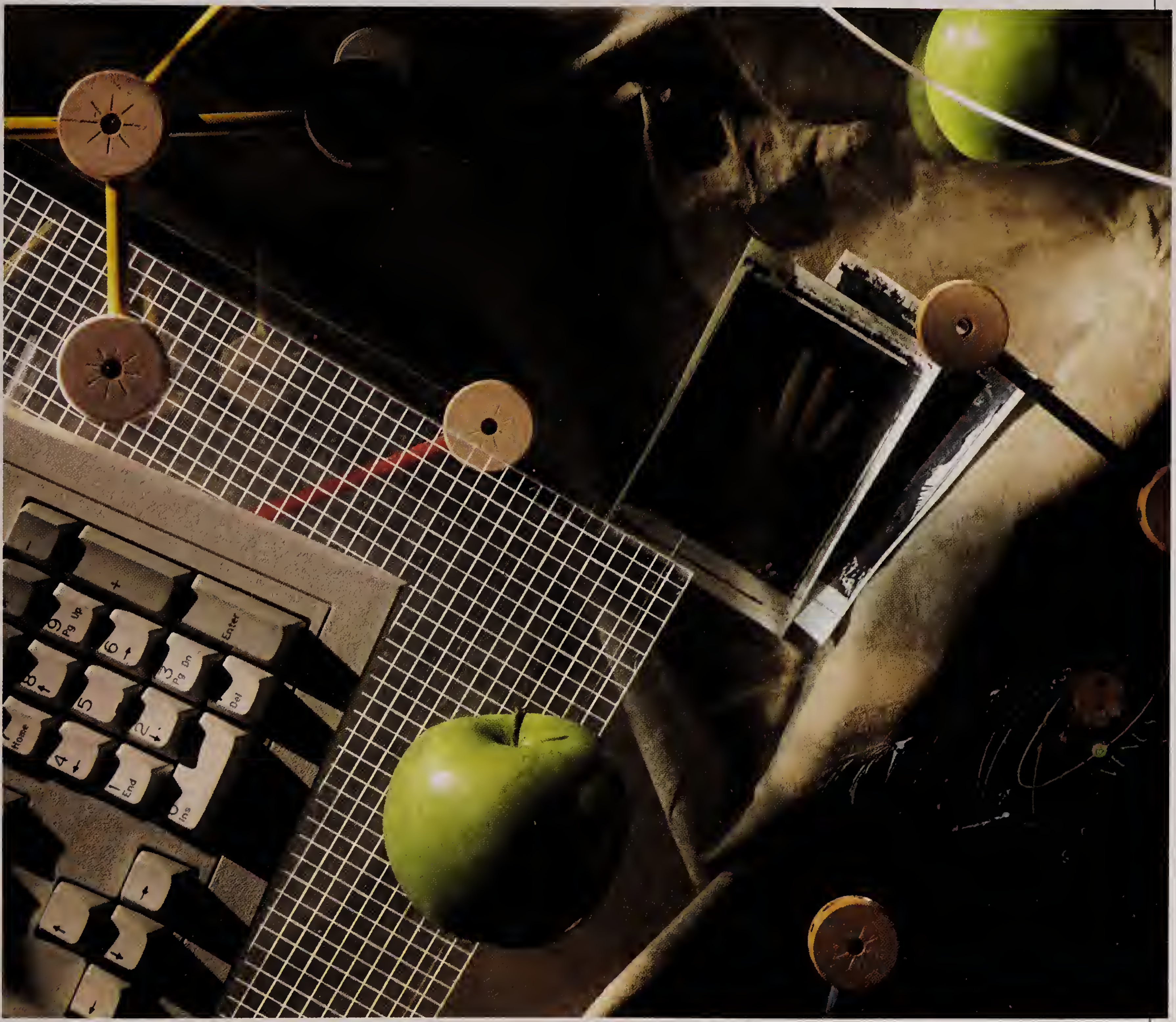


PHOTO BY RALPH MERCER

environments are characterized by a lattice of multiple platforms (different size boxes, often bearing the imprint of different vendors) sharing data, applications and processing burdens across organizational functions. In other words, distributed computing strategies are pluralist, interdisciplinary and geographically dispersed—a melting pot of solutions.

One handy way to sort out the shades of distributed computing is to view them as neighborhoods in a rapidly changing city. Downtown, mainframes, minicomputers and workstations talk to each other frequently but live lives apart. Distributed computing in this neighborhood is rudimentary and is often used as a strategy intended to solve a single problem.

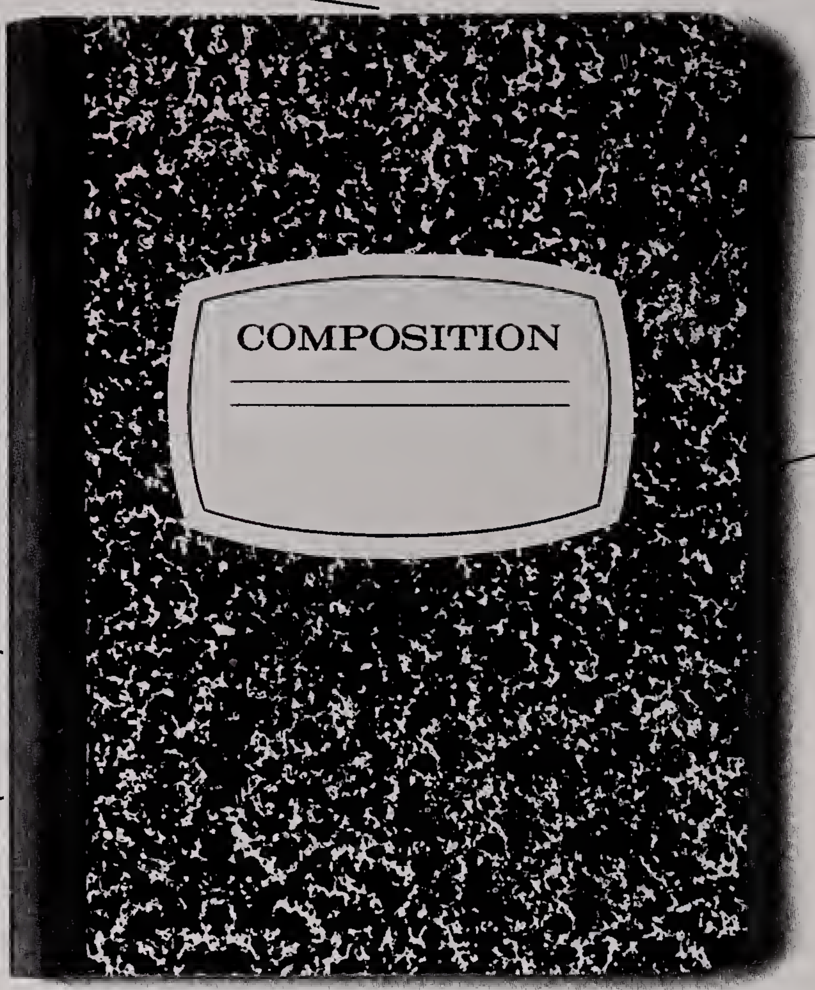
For example, PPI DelMonte Tropical Fruit Co., headquartered in Coral Gables, Fla., uses a distributed network of PCs and mainframes to retrieve financial information from its operations in Guatemala and Costa Rica. The Latin American units download financial data from their large machines to '386-based PCs running a specialized application, then transmit the data via Telemail (a store-and-forward service) to a PC in Coral Gables. The financials are then consolidated on the PC and uploaded to the corporate mainframe.

DelMonte Vice President of Information Services Luis Fresquez notes that the company could communicate "mainframe to mainframe with Latin America, but it's complex and the cost is high. It's much cheaper to do this with a PC."

In this neighborhood distributed computing may also involve communication between stand-alone networks and a corporate or de-

Distributed computing strategies are pluralist, interdisciplinary and geographically dispersed—a melting pot of solutions.

Dimensions: 7.5 x 9.75 x .25″



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partmental machine, such as call-up access to structured information in a mainframe or a mini. Boulevard Bancorp of Chicago, for instance, is beefing up its use of microcomputers and has its eye on networks of desktop machines roped together in a token ring and linked to mainframes through gateways. (This will replace the 3270 emulation links currently used by the bank.) Boulevard recently acquired other banks, outsourced all of its back-office data processing to Systematics Inc., a computer software and data processing firm headquartered in Little Rock, Ark., and reorganized its IS organization. Now the bank intends to put more information onto the desktop—and that calls for the sharing of data between the mainframe and the network, and for distributed applications.

Distributed databases are also downtown *modus vivendi.* "With distributed databases you probably have a new application [on your intelligent workstation], but you may very well be accessing old data [on the mainframe]," said Glover Ferguson, Foundation Product executive at Andersen Consulting in Chicago. "You shoot an SQL statement into the air, and where it lands, you know not where."

> **"With distributed databases you probably have a new application on your intelligent workstation, but you may very well be accessing old data on the mainframe. You shoot an SQL statement into the air, and where it lands, you know not where."**
>
> *–Glover Ferguson*

Ferguson noted that there are four classic problems encountered when developing distributed databases. "The first is location," he explained. "Where is the data and how do you find it? How do you join tables on two different nodes? The second is partitioning, where you have one type of data one place and another type another place.

"The third issue is replication," Ferguson continued. "For performance reasons, I may wish to have copies of certain data at certain locations." But if a user makes a change on some piece of the data, how soon and in what fashion is that change communicated to

Getting Under the Customer's Skin

Some vendors of technology services are splicing themselves into their customers' information bloodstreams

As corporate networks evolve, vendors like US Sprint Communications Co. and GE Information Services are adopting new communications technologies to route information—including graphical, audio and video information. GE Information Services, a Rockville, Md.-based teleprocessing provider, wants to move its applications business right down into the customer's shop—to become not just the veins and arteries of network communications, but the capillaries as well. Today GEIS provides EDI and other business-to-business services. Tomorrow GEIS wants to integrate those services with a company's internal systems, through LANs and distributed gateways. Additionally, GEIS is adopting StrataCom Corp.'s Fast-Packet switching technology to provide virtual circuit services to customers abroad. Among other uses, this technology will enable GEIS to manage the capacity of the many lines and switches in its network so that it can provide customers with tremendous (and varying) amounts of bandwidth on demand—a "virtual" dedicated leased line, at a far lower cost.

US Sprint Communications, based in Kansas City, Mo., has its eye on the interconnection of LANs and WANs, teleconferencing, networking images and video, and the creation of applications for intelligent communications. As customers upgrade to FDDI networks, Sprint will upgrade to SONET and frame relay.

–T. Kiely

other nodes? According to Ferguson, that gives rise to the fourth problem: data integrity. Integrity can be a complex issue when data partitioned on different nodes is updated at irregular intervals—or when one node's updates are lost.

But complex distributed database problems are tackled more earnestly a few blocks farther north. The midtown neighborhood is faster, jazzier, looser—and distributed computing strategies are more sophisticated. The buzz phrases here are "client/server" and "peer-to-peer."

Datapro Research, a publishing company in Delran, N.J., draws a distinction between midtown's buzz phrases this way: "A client/server architecture divides an application into separate processes operating on separate CPUs connected over a network. Client/server computing is inherently one-way, unlike peer-to-peer communications in which both processors can send instructions to one another."

Michael Millikin, editor-in-chief of *Network Monitor*, a research report published by Patricia Seybold's Office Computing Group in Cambridge, Mass., offers a similar description of client/server as "a model of communication within a distributed environment. [It] basically defines a request/response means of communicating between two processes." Basically, he added, that *could* occur even within a single workstation—as in a client/server window application—"but it gets interesting when you distribute those processes across a network."

There are a variety of client/server strategies, Millikin continued, "whether you're just distributing the interface or whether you're distributing some of the application processing along the lines of the remote procedure call [RPC] mechanism, or whether you're distributing data. The way people intend to use [client/server] initially is for front-end data access."

Clients and servers can communicate in either a synchronous or asynchronous manner. When a client machine fires off a synchronous message, it then sits and waits for a response from the server. (RPC, a communications software technology that facilitates the extension of conventional procedure calls across a network, is synchronous communication.) In asynchronous communication the client still expects a response, but it doesn't pause and wait for it—it keeps busy. Most networks will need both methodologies, addressed to different networking needs. File retrieval can be synchronous, Millikin observed, but "if you are doing real-time process monitoring in a manufacturing operation, you probably don't want a distributed computing solution that uses a remote procedure call." An asynchronous solution would be better.

> **"When you go from client/server to cooperative processing, development of applications is conceptually much more difficult. We are upgrading the intellectual skills needed for design."**
>
> *–Peter G.W. Keen*

Datapro notes that client/server architectures allow corporations to downsize applications from mainframes to less expensive processors. Because the client machines handle the user interface, servers can handle more users, and more users can access data concurrently—without significantly degrading performance. On the other hand, start-up client/server costs can be high for companies that must incorporate new PCs into environments dominated by time-sharing systems and cheap, dumb terminals. Client/server computing can also tax a corporation's network performance, Datapro noted, because clients and servers swap large quantities of data, interactively, file by file. Client/server architectures need much greater bandwidth than old-fashioned timesharing systems.

Finally, Datapro and Millikin agree that most client/server development is unfolding

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On a Cross-Functional Basis within Certain Major Business Units	49
For Selected Business Functions such as Marketing or Distribution	45

**Respondents who have implemented or plan to implement distributed computing within a year*

Cooperative Processing Takes Off

Two airline systems have turned blue-sky technology into high-flying real-time benefits

Cooperative processing isn't the future at the two airline systems giants; it's the present. Covia (owned by a consortium of airlines) is working to provide the capabilities to process any type of function, application or data across multiple systems. To do this, Covia developed a set of what Mark Teflian, president of Covia Technologies Inc. in Rosemont, Ill., a subsidiary of Covia, calls middleware—a software "virtual network" that sits on top of multiple vendor operating systems. Covia's middleware distributes functions and applications across a worldwide multivendor network of clients and servers, of LANs and WANs.

"With cooperative processing we've been able to do business applications unheard of before," Teflian said. For example, Covia can give price quotations on the lowest fare for any carrier in the world, 200 times a second—using a distributed system dedicated to a piece of the work. Essentially, Covia has begun to nudge transaction processing out of the old world of batch work into a new one where transactions and work are routable across a network. Teflian foresees profits for fast transaction processing services in many industries. "Time is money," he said. "But real time is real money."

Sabre Computer Services in Tulsa, Okla. (an operating division of American Airlines), has integrated three levels of networked systems into one big heterogeneous distributed computing environment. First, the Sabre CRS system (typically used by travel agents to book airline seats and provide other travel-related services) is a centralized system, linking mainframes to networks of MS-DOS machines.

Airline agents at airports use a more robust network. Diskless terminals at the airport gates or customer counters tap the same mainframe Sabre system, but the airport network performs many more functions than the travel-agent network, and is larger. These two network levels distribute processing, but not data.

Within the parent company's corporate offices, however, LANs of MS-DOS- or OS/2-based machines tie into a number of different systems (including Sabre) and run a rich mix of database and end-user applications. The three levels are interconnected by a common WAN—so, too, are the RISC-based Unix LANs in engineering and maintenance departments.

The diversity and heterogeneity of AMR systems is a deliberate strategy, according to Jim Juracek, vice president of systems engineering at Sabre Computer Services—not just a decision born of the necessity to leverage the company's multiple computing environments. "We've tried to identify basic architectures that seem to be appropriate for the business problem we're trying to solve, and then adapt them," he said.

–T. Kiely

inside the large corporations that plan to use it—off-the-shelf distributed applications aren't yet available. "The people who will make [distributed computing] go are the people who are writing the applications in-house," Millikin said.

Vendors such as IBM, Digital Equipment Corp., NCR and Hewlett-Packard are positioning themselves to deliver distributed solutions, and both the Open Software Foundation's Distributed Computing Environment and Sun Microsystems' Open Network Computing environment are intended to be distributed software architectures. As customers choose vendors for the hardware, software and communications wares to use in a distributed computing infrastructure, Millikin said, "one of the criteria will have to be, 'how much can I depend upon them for service and support?' "

Andersen Consulting's Ferguson speaks for many industry watchers when he says that the future of distributed computing is cooperative processing (see "To Each Its Own," *CIO*, April 1991). This is uptown computing: brash, forward-looking and distributed to the max. Cooperative processing will comprise enterprisewide, heterogeneous networks; distributed databases and applications; distributed processing; common interfaces across the network; and distributed (and very complex) network management.

"Cooperative processing allows the unit of business work to be created on any proces-

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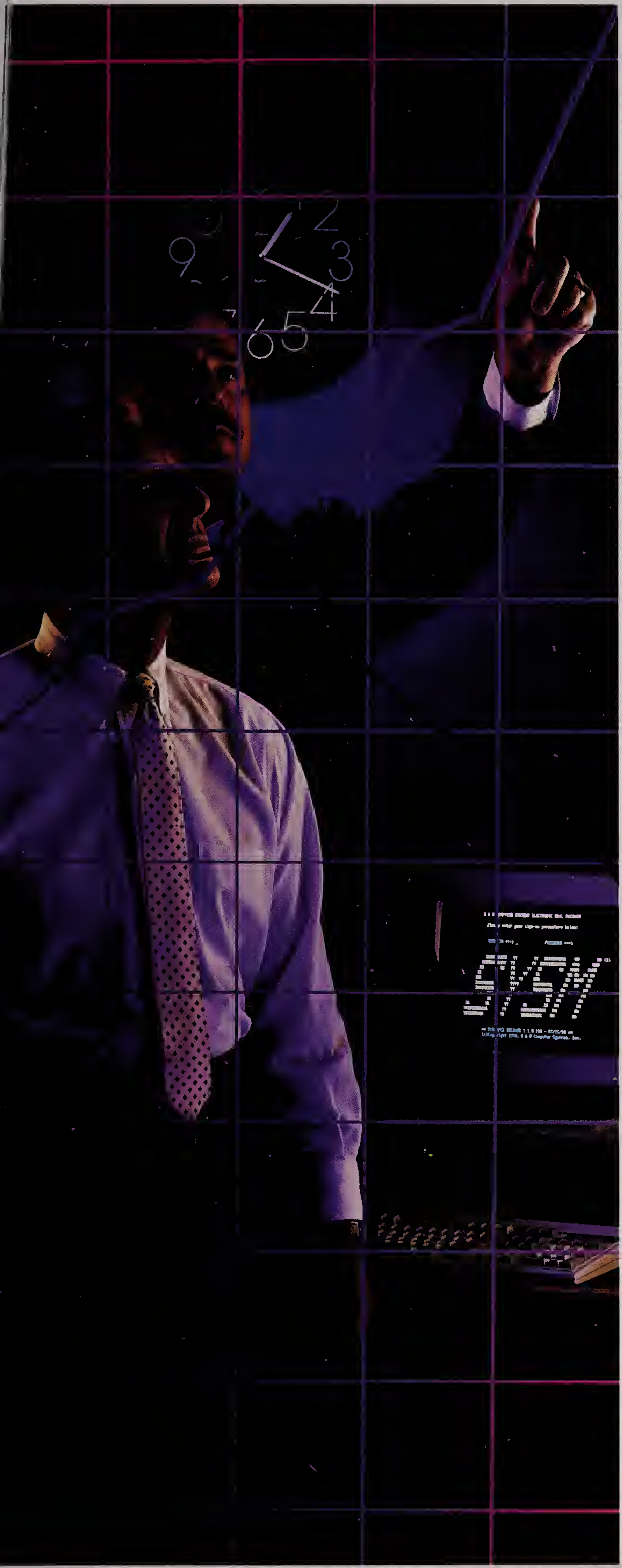

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sor in the network," said Covia Technology's Teflian. He noted that Covia, like most IT-intensive companies, installed a hodgepodge of disparate systems over the years; realistically, Covia's pursuit of cooperative processing had to begin with a strategy for retaining what it already owned—yet somehow link these systems together in an enterprisewide network. Teflian says his company created a layer of software that envelops systems diversity, creating what he refers to as a "virtual network" populated by "a community of operating systems" (see related story, Page 50). For Teflian, cooperative processing is peer-to-peer and the architecture is fluid. The mainframe is just another node on the network, not the data centerpiece, and at varying times clients may also be servers, or servers clients. In this way the applications and data can go where they are needed, throughout the network.

Network management of heterogeneous, multistandard-based systems and security could prove to be the most complex hurdles companies will face as they move toward cooperative processing.

Cooperative applications will be designed to take advantage of a number of computers in a number of locations, noted Norman Weizer, a senior consultant at Arthur D. Little Inc., in Cambridge, Mass. A portion of such an application might run on the mainframe, another portion on a departmental system or a server, and a third portion on a PC.

The development of cooperative processing applications requires new skills, noted Peter G. W. Keen, executive director of the International Center for Information Technologies in Washington. Keen and others believe that in cooperative processing environments users will interact with the network through objects, similar to the way Macintosh users today call up a word processing program or a file by invoking on-screen objects.

For instance, a user might gain access to a facilities management application, and within that program another object may be linked to a graphic image or full-motion video. But such object-oriented systems will require design skills vastly different from those used to cobble together LAN client/server applications.

"It's a different art," Keen explained. "When you go from client/server to cooperative processing, [development of applications] is conceptually much more difficult. You're trying to design object-oriented applications like Lego blocks. So the more we go in this cooperative processing direction, we are upgrading the intellectual skills needed for design."

Moreover, said Keen, "the other [problem] is that the sharp edge in development has been around the LAN and the workstation. Cooperative processing shifts the emphasis back to the power of operating systems and the really powerful relational-database management systems. Because the weakest area of all is that we are still very primitive yet on a true distributed relational database." Others add that network management of heterogeneous, multistandard-based systems and security could prove to be the most complex hurdles companies will face as they move toward cooperative processing.

On the other hand, new communications technologies, such as frame relay, can only help to push the development of cooperative processing systems. "The barrier to [cooperative processing] won't be the communications," said Millikin. "We will get the bandwidth we need to the desktop when there is an application need for it. We're not going to be prevented from doing this by bandwidth or by processor speed or by memory cost." CIO

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BUILDING TO SPECS

The Shape of the Peg

When designing a distributed computing structure, savvy CIOs know it's folly to try to pound a square peg into a round hole

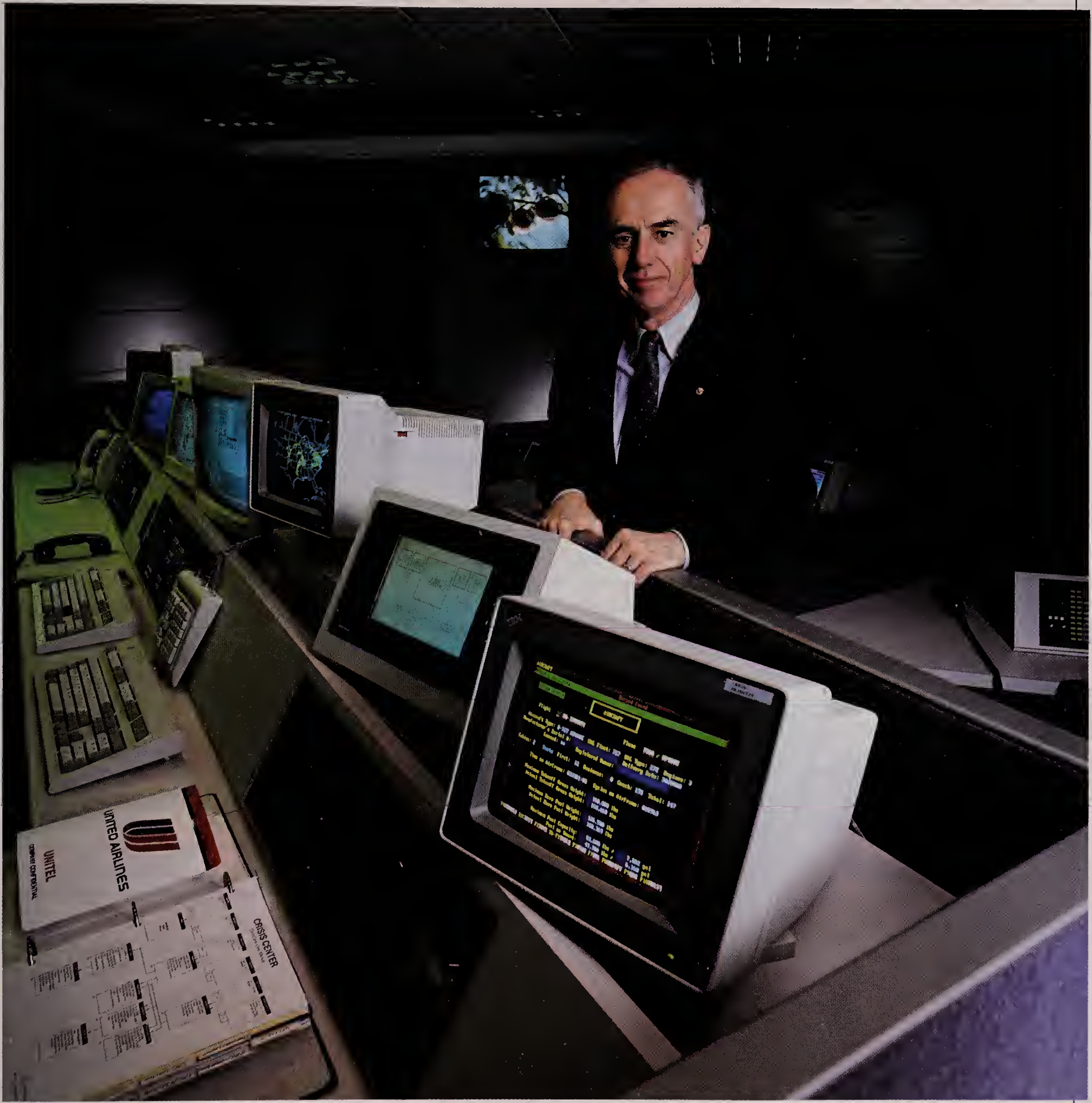
BY MEGHAN O'LEARY

As businesses have matured in their IT use, corporate information systems have increasingly been modeled after the corporations themselves, reflecting organizational and business needs rather than the latest innovation. Businesses that have decentralized for competitive and cost reasons have invested in telecommunications and moved computing power outward to business units, while organizations with less complex or less time-sensitive operations have remained informationally centralized. In short, a computing system can only be as distributed as the company it serves.

The fastest exodus from central to distributed systems has taken place among companies with structures that require analysis and decision-making at remote locations and the sharing of that analysis with a central location. The systems are often designed to address the competitive and quality problems that arise from delays and off-site decision-making.

Morrison-Knudsen Corp., a design, engineering and construction firm in Boise, Idaho, has been supporting remote decision-making since long before the introduction of PC-based distributed computing. In the 1970s, according to Steven R. Johnson, director of information services, the company put minicomputers and even mainframes at construction sites to allow administrators, project managers and engineers to analyze financial, project management and engineering information across a broad range of computing platforms. Today, while the sites still sometimes use minis (large systems can be cost-effective when a project lasts several years), powerful PCs, LANs and multiuser systems are the norm.

In addition to giving on-site engineers access to plans, a distributed system allows four major engineering offices and several smaller satellite offices to share design information during development. "CAD [computer-aided design] used to be a big drag on the host computers," said Johnson, but a wide area network of powerful CAD workstations linked to a CAD server at each office has given engineers the power and fast commu-



DON KARMAZIN *expects distributed computing to bring new speed and responsiveness to United's maintenance operations and flight schedules.*

nications they need to work effectively.

For some companies, the speed and accuracy with which remote sites manipulate a lot of information is critical to optimum performance. Said the head of MIS for one Northeastern retailer that linked LANs in stores to the corporate mainframe: "We have a large group of people [at stores] who need to look at, massage, extract and do projections of our merchandising needs based upon the transactions that are happening on a day-to-day basis. We're constantly looking to determine how [sales] will affect our gross margins. To try to do this in a strict mainframe environment is, at the very best, exceedingly difficult."

Speed and responsiveness are equally important to Don Karmazin, vice president of MIS for United Airlines in Elk Grove Village, Ill. Karmazin has begun implementing distributed computing in the carrier's scheduling and maintenance operations to support United's flight schedules and keep its planes in the air.

Crew scheduling is based on a complex mathematical modeling process involving

PHOTO BY NEIL MACDONALD

flight schedules, shift lengths and such real-time information as delays and cancellations. "You want to design schedules that minimize the amount of time that [pilots and flight attendants] are not able to perform effectively," Karmazin said. "You don't want them waiting on the ground." The performance of this modeling process is limited on the mainframe, he explained, because it must compete with other applications. Also, the central office cannot always stay abreast of last-minute changes at the airports. Karmazin is installing powerful networks in Chicago and Denver that will handle the modeling and share the information with United's central scheduling database.

The key to United's success lies in being able to handle large amounts of information where the work is being done. Advanced data collection via bar coding in a distributed environment has improved United's maintenance efforts by getting the mechanics out of paperwork and into repair work. Mechanics scan bar codes on parts and forms as they record their work hours, and "there are a lot of productivity [gains] in the process," Karmazin said. "They get much better information about the time it takes to do a specific type of task. They schedule better." Bar coding also allows United to track usage of parts and supplies more efficiently and to keep smaller inventories.

Where speed is not an issue, vast amounts of information often are. In 1987, after 16 years of centralized IS management, Lennox International Inc., a Dallas manufacturer of heating and air-conditioning systems, began to grapple with tracking orders, parts and shipments, as well as with computer-integrated manufacturing, at remote factories and sales offices without overloading the corporate mainframe.

"There are applications out in the remote locations that have key elements of information that are not needed on our host mainframe," explained Vice President of Management Information Systems Harlan D. Zier. "In many cases these applications are unique to that operation." Lennox has warehouse locator systems (designed to locate parts or pieces of equipment) at each of its six divisional sales offices, which serve all of the company's factories and warehouses. In recent years Lennox has begun bar coding and scanning equipment to verify production levels, pick lists, shipping orders and inventory. The old locator method relied on a manual card file.

"Distributed processing is a facility that serves both worlds by providing the controls and the information," Zier said. "[It] has allowed us to streamline, to make this process less laborious and to provide much more comprehensive data [while still keeping central control]. It requires fewer people in the warehouse, eliminates confusion and [ensures] better service."

The paradox for Lennox is that distributed computing allows it to tighten central reporting from decentralized business units. Wilson Sporting Goods Co. of River Grove, Ill., benefits from the same paradox as it applies distributed computing to achieving economies of scale. Because it now collects more information and provides powerful tools with which to analyze it at remote sites, the company is considering moving such centralized functions as customer service, credit, payroll and personnel out to its six regional sales offices. Wilson's product

MARK ROWELL: *"When we looked at what fit our company, we came to the conclusion that we needed to have the ability to distribute the workload day-to-day."*

PHOTO BY CINDY CHARLES

profit centers are separate from its administrative service cost centers. Recently, Wilson decided that the profit centers would incorporate the overhead of administrative functions into their profit plans and, it hoped, use the services more selectively. A distributed system would support such a plan, allowing the offices autonomy while still enabling them to share financial information and analyses with headquarters.

Information is equally important to the divisional autonomy and corporate profitability at Bundy Corp. of Warren, Mich., a manufacturer of small-diameter steel tubing for the auto industry, among others. Bundy has 12 manufacturing locations throughout the Northwest that, in the past, have been considered cost centers. The company is planning a distributed computing architecture that will allow factories to analyze manufacturing, sales and inventory data on powerful PC networks rather than using the overloaded corporate mainframe. Factory managers will be able to make immediate decisions about output and customer service that will positively impact their performance and allow them to act as profit centers. “I could never see the real benefit of sending a piece of information 500 miles to process it,” said Bundy’s director of business systems, Richard L. Willoughby. The factories need to have qualitative analyses in time to react to the information, he explained. “If you have a problem in the production areas, it’s no good knowing about it at the end of the week or the month.”

For some companies, the speed and accuracy with which remote sites manipulate a lot of information is critical to optimum performance.

Factory environments such as those at Lennox, Bundy and Wilson often rely on ’round-the-clock or just-in-time manufacturing processes that, if interrupted, can cost the company money. In addition to the importance of having information on hand where things are happening, Willoughby said, a distributed system can support manufacturing operations in case of a communications network failure between factories and the mainframe. Lennox’s reliance on distributed processing is growing so rapidly, said Zier, that the company expects to cut its already reduced online processing to remote sites by half again.

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Chief Anticipated Benefits

More Effective Communication among Functions	73%
Improved Customer Service	65
Ability to Create a Central Database Accessible by PCs or Workstations	56
Ability to Develop New Applications	48
Cost Savings	43
Faster Time-to-Market	36

Respondents weighing the financial benefits of distributed computing were almost equally impressed by the increase in processing efficiencies (49 percent) and the cost savings of downsizing (45 percent).

The kind of control that these companies hope to gain by giving their operating units more processing power becomes critically important when offices are farther flung, as in the case of Abekas Video Systems Inc., a maker of production digital video systems with offices in Redwood City, Calif., and Reading, England (just outside of London). “[When] we looked at what fit our company, we came to the conclusion that we needed to have the ability to distribute the workload day-to-day,” explained Abekas Director of MIS Mark S. Rowell. “We’re running two different factories, and we couldn’t do it with [just] one computer in the U.S.”

The company is planning to link its VAX minicomputer in Redwood City to Ethernet networks at factories in the United States and Novell networks in England. A distributed environment will help the company to better track and manage inventories and production levels. “Inventory is a non-producing asset,” Rowell explained. “It’s a real issue. It has implications for our manufacturing process in terms of moving to a competitive environment and just-in-time manufacturing.” Standardization of such information as parts numbers can help the company avoid waste, delays and missed deliveries.

“It’s important that there be a certain amount of local control,” Rowell continued, “[although] that rubs up against our issues of corporate consolidation in just about every one of [our operational] areas.” Abekas is

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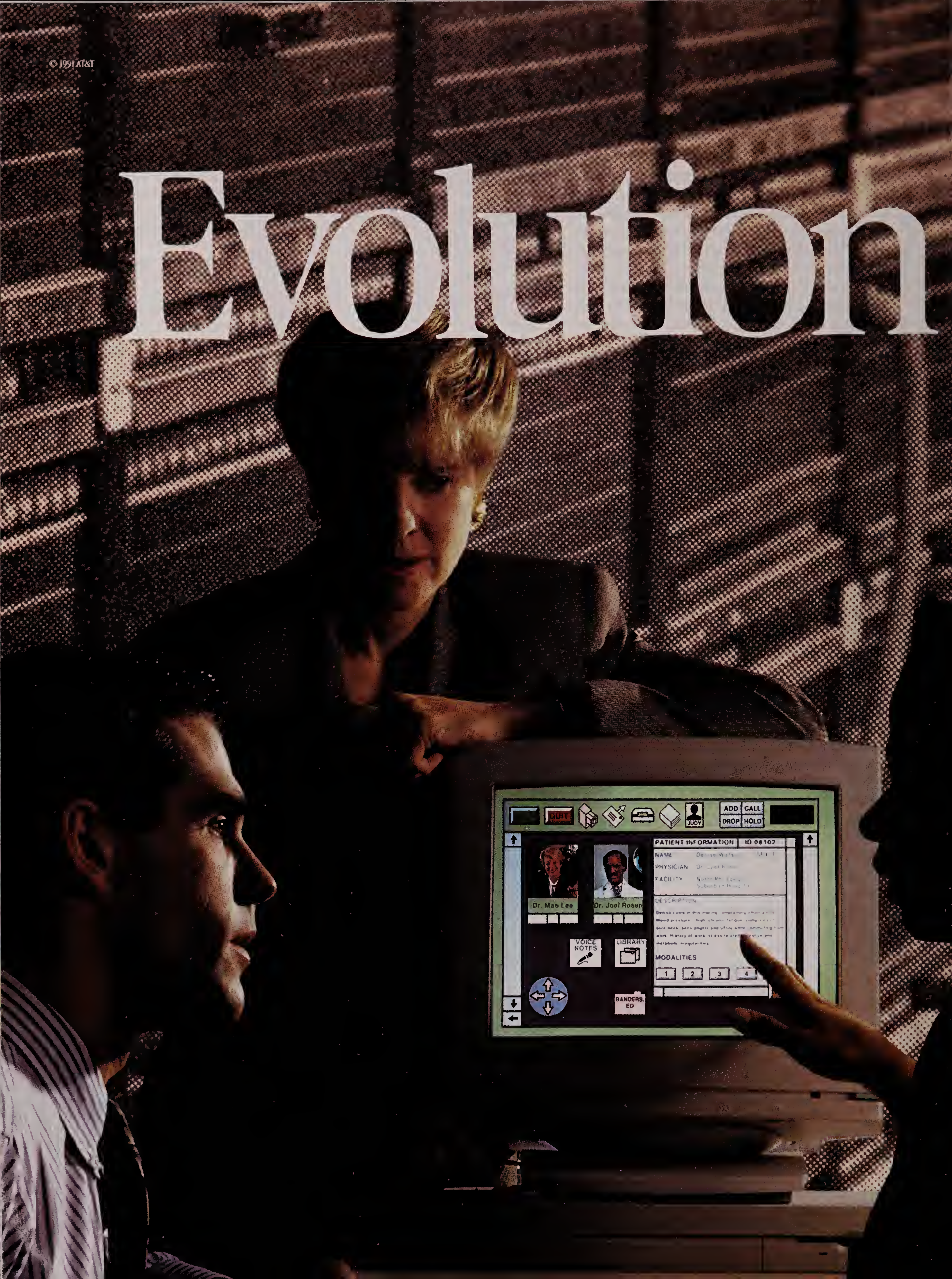
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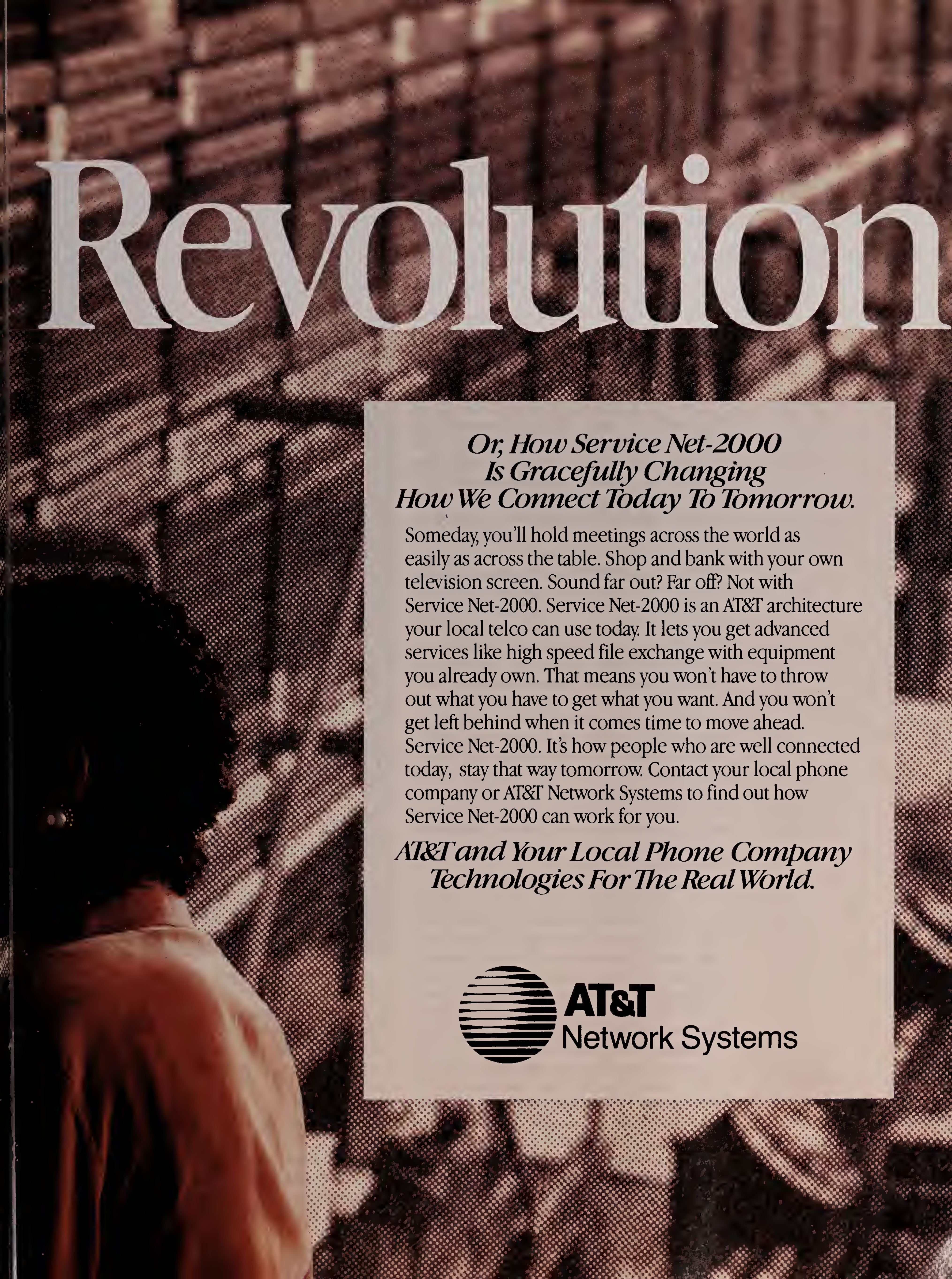

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trying to resolve those issues through centralized planning processes that govern the design of distributed applications and data definitions.

A distributed environment also allows Abekas to deal with the eight-hour time difference between its two offices. The London staff is "going home when we're showing up for work," Rowell said. A distributed system, coupled with E-mail, allows managers to access information across an ocean, a continent and a multivendor architecture without needing someone at the other office.

Not every company is as response-driven, as large, or as complex as an Abekas Corp., however, and therein lies the most compelling argument against investing in distributed computing: Some organizations are simply not ready for the commitment. "The traditional reasons don't really apply to us right now," said Jeff Olszewski, data processing manager for Beloit Lenox Inc., a manufacturer of paper-making machines based in Lenox, Mass. The company, which each year evaluates distributed computing and each year decides against it, is fairly small and centralized. According to Olszewski, the systems department is lean, and the company's 60 online mainframe users and 40 more occasional users enjoy good response time. The DP department's applications backlog is "manageable," in Olszewski's words. "I think it goes without saying that we certainly will be reconsidering it in the future," he said. "But as long as the users are being served and their information needs are being met, we'll probably [stick with centralized computing]."

Larger businesses find that size does not necessarily preclude centralization. R&B Realty, a national company that owns and manages apartment complexes designed for short-term business use of 30 days or more, operates almost exclusively within the parameters of its central reservation system (CRS). The CRS handles reservations, rental of furnishings and housewares, utility ordering, and even maid service.

"From a central site, logistically it's a lot easier," said Chuck Dyson, vice president of MIS for the Los Angeles company. R&B's Hewlett-Packard mainframe supports eight regional sales offices with 100 sales representatives working on dumb terminals. In addition, each property is equipped with a terminal that provides online access to tenant and reservation information. R&B's 490 users make reservations in 20 cities, record rent payments and schedule utility hookups. On average, the company has a 90 percent occupancy rate. Without centralized information, a tenant could go without accommodations, heat or a favorite cable channel and leave dissatisfied.

CHUCK DYSON *questions the cost and capacity arguments he's heard for distributed computing.*

Dyson questions the cost and capacity arguments he's heard for distributed computing. The cost of maintaining online communications at R&B is far less than the cost of reequipping and reconnecting every property and office in every city. Moreover, he said, "you're continually having to upgrade

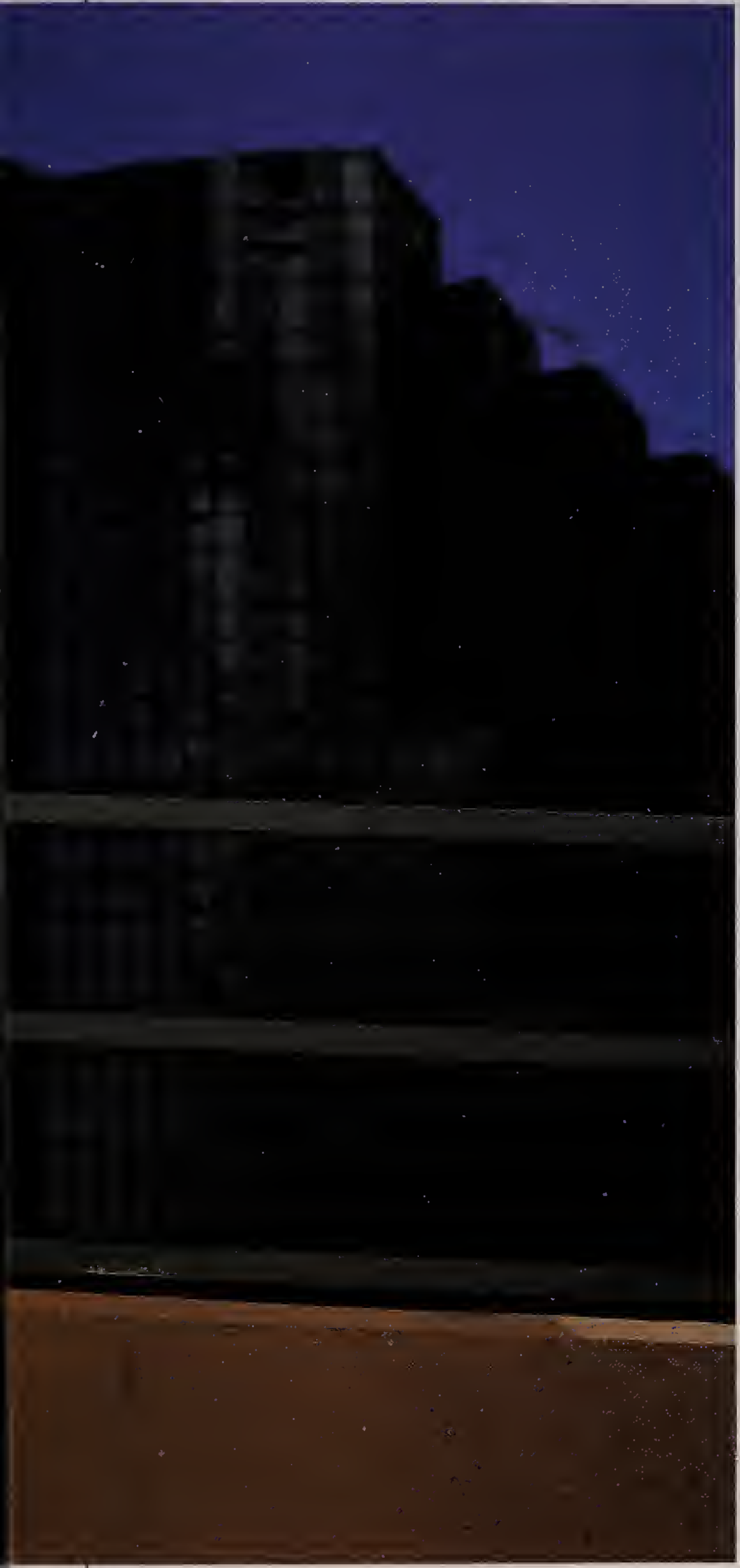


PHOTO BY ALAN LEVENSON

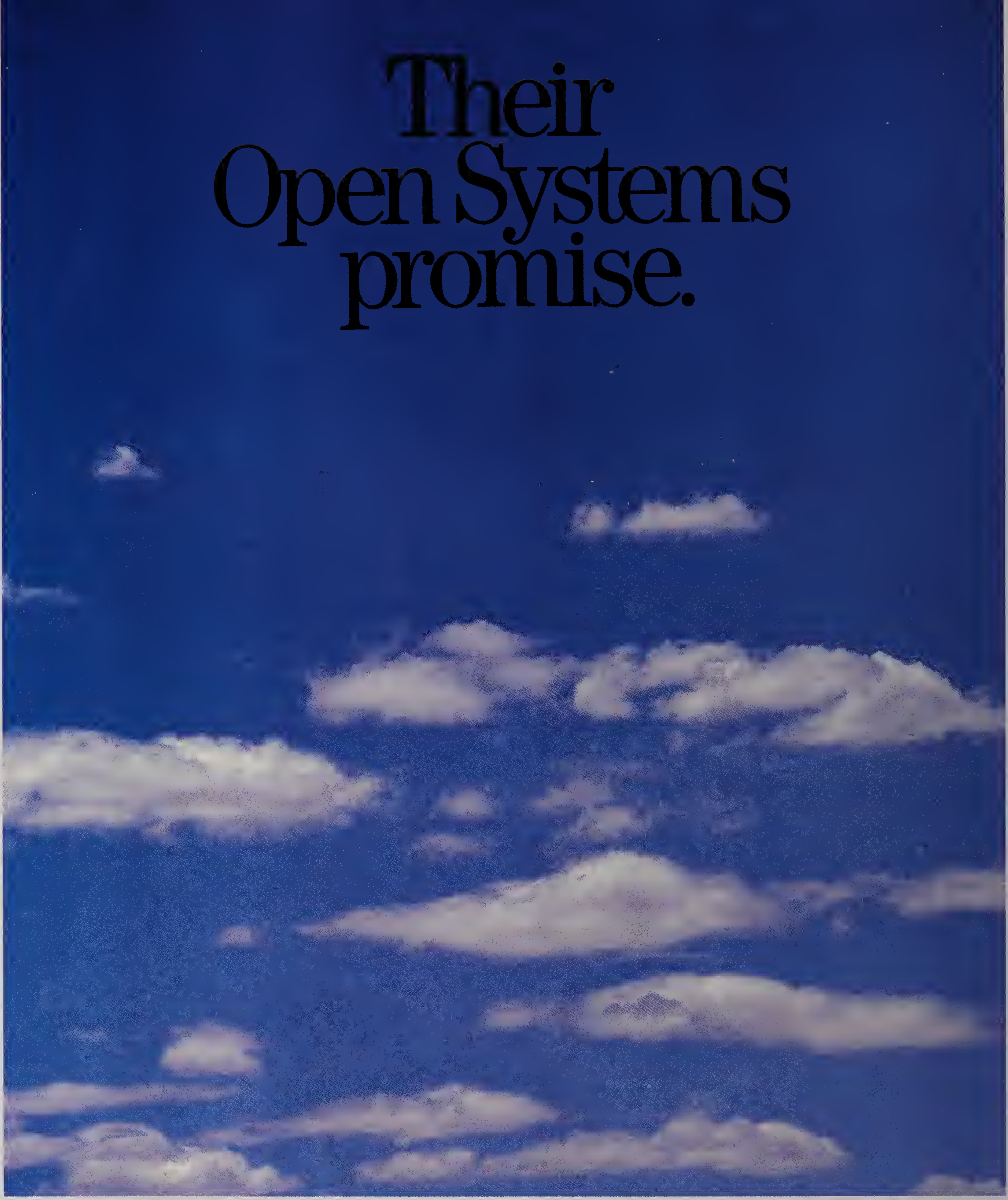
> **"I believe that the manufacturers of computer equipment, prior to having enough power in the minicomputer world, sold distributed computing as a way around their lack of power."**
>
> *–Chuck Dyson*

the distributed systems." In addition, R&B's brand new, top-of-the-line mainframe can easily handle the workload. In fact, Dyson thinks distributed computing may well have been a Band-Aid for manufacturers rather than users. "I believe that the manufacturers of computer equipment, prior to having enough power in the minicomputer world, sold distributed computing as a way around their lack of power," he said. "Now that they've got [more powerful machines, they] don't push distributed computing as hard."

Regardless of the power of installed equipment, many companies have built too much momentum in the direction of departmental or centralized computing to make distributing before they absolutely need to a financial likelihood. Massachusetts Mutual Life Insurance Co., in Springfield, Mass., is a business that finds itself entrenched in departmental computing because its needs and volume grew faster than the available technology. "In the insurance business, computerization started a long time ago," said Stephen A. Hawkins, senior vice president of information systems development. "It started as the automation of a labor-intensive function. You built the process necessary to automate a particular function. And you didn't worry about the fact that in a different part of the organization, somebody keeps track of something else using the same information. You oftentimes recreated the data. . . . We probably have 10 or 15 different definitions for what a commission is."

Hawkins believes that the company will eventually embrace distributed computing, but not until the software and development tools are good enough and available enough to make the transition as cost-effective as possible. "I do not see any limitations or things holding us back from a business perspective," he said. "But from a systems developer's perspective, there is not a rich set of tools available. You almost have to custom-build it for each application."

Other CIOs agree that technology limitations have often held them back, regardless of a corporate commitment to distributed computing. But they add that a mature technology will not sit well on a shortsighted technology plan. Said Morrison-Knudsen's Johnson: "Even before computers, our business was such that decision-making close to the project was needed to execute [construction projects] effectively. And so the computer and communications plan has followed the company's organization. The decision wasn't [made when] all this hype about distributed computing came about in the last few years. That's just the way our business worked." CIO



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THE DEMOCRATIC PROCESS

Law and Disorder

The irony of distributed computing is that bringing power to the people also means bringing new problems of command, control and burden-sharing to CIOs

BY PAUL KONSTADT

Distributed computing has brought change to its adopters' management infrastructures and styles just as surely as it has to their technical architectures. CIOs have learned that rigid hierarchies and linear organizational relationships don't hold up under flexible distributed technologies. They have also learned that politics and persuasion are more effective than authoritarian compulsion, and that providing guidance to empowered users is more time- and resource-consuming than imposing rigid solutions on submissive employees.

"It is traumatic," said Jim Newman, who is overseeing a transition from central to distributed computing as director of information systems for Precision Castparts Corp. of Portland, Ore., a maker of aerospace and medical components. Despite personal distress, Newman said he supports the effort because the business benefits of distributed computing are compelling. "I am an executive of Precision Castparts, not an IS department, [and distributed computing] will save a bundle of money for the company," he said.

The organizational difficulties in making the transition can start early, especially when an essential distributed computing resource like telecommunications is controlled outside the IS group. Such control may be vital to the success of a distributed computing effort, but as John Collins, vice president of IS at Boston Gas Co., found out, adequate managerial purview cannot be commanded or foreordained; it has to be fought over with peers.

"It was the old story," Collins recounted. "The operations people said they were the ones who use [Boston Gas's extensive private telephone and two-way radio network], so they should control it." The debate was laid before the president of the company. He was persuaded by Collins' argument that IS and telecommunications were converging technologically, and so gave IS control of communications resources. "There has been absolutely no residual jealousy," Collins said. "Or if there has, I haven't seen it."

Basic organizational control is only one departmental turf issue encountered by CIOs moving from centralized to distributed computing management. As the new technological approach becomes more deeply en-

PHOTO ILLUSTRATION BY RALPH MERCER

trenched in basic business practices, it spawns new struggles over the limits of IS- and user-controlled dominions. In response, CIOs have created new middle management structures or significantly altered their existing schemata to manage power sharing with users while at the same time maintaining data and applications integrity.

"That is our real concern," said Bradley Dugger, CIO for the state of Tennessee. "As power goes to the PCs, we're constantly looking for ways to restrict the options for harm" from conflicting applications, overlapping databases and technical incompatibility.

Dugger is the architect of a statewide distributed processing system. It is intended to provide for the IS needs of all state operating units, many of which have long traditions of managerial autonomy. There is little if any administrative interaction among the various Cabinet secretaries' organizations, except for that which is mandated by civil service, competitive bidding and other legal requirements. Before Dugger was brought in as CIO, there was virtually no sharing of data or IS resources.

"[The governor's] philosophy is that data belongs to the state and not to the individual departments," said Dugger. "[But] we still have users who disagree; they say, 'This is mine; I ought to control it.' Those [resisters] have to realize that [shared IS] is now a part of state management."

To enforce mandates for interdepartmental IS harmony and to assure coordination among dispersed users and IS developers, Dugger created two new management units in central IS. The data administration group ensures that database and file structures remain consistent and that each database is

The shift to distributed computing dissolves once-clear organizational relationships.

CIO

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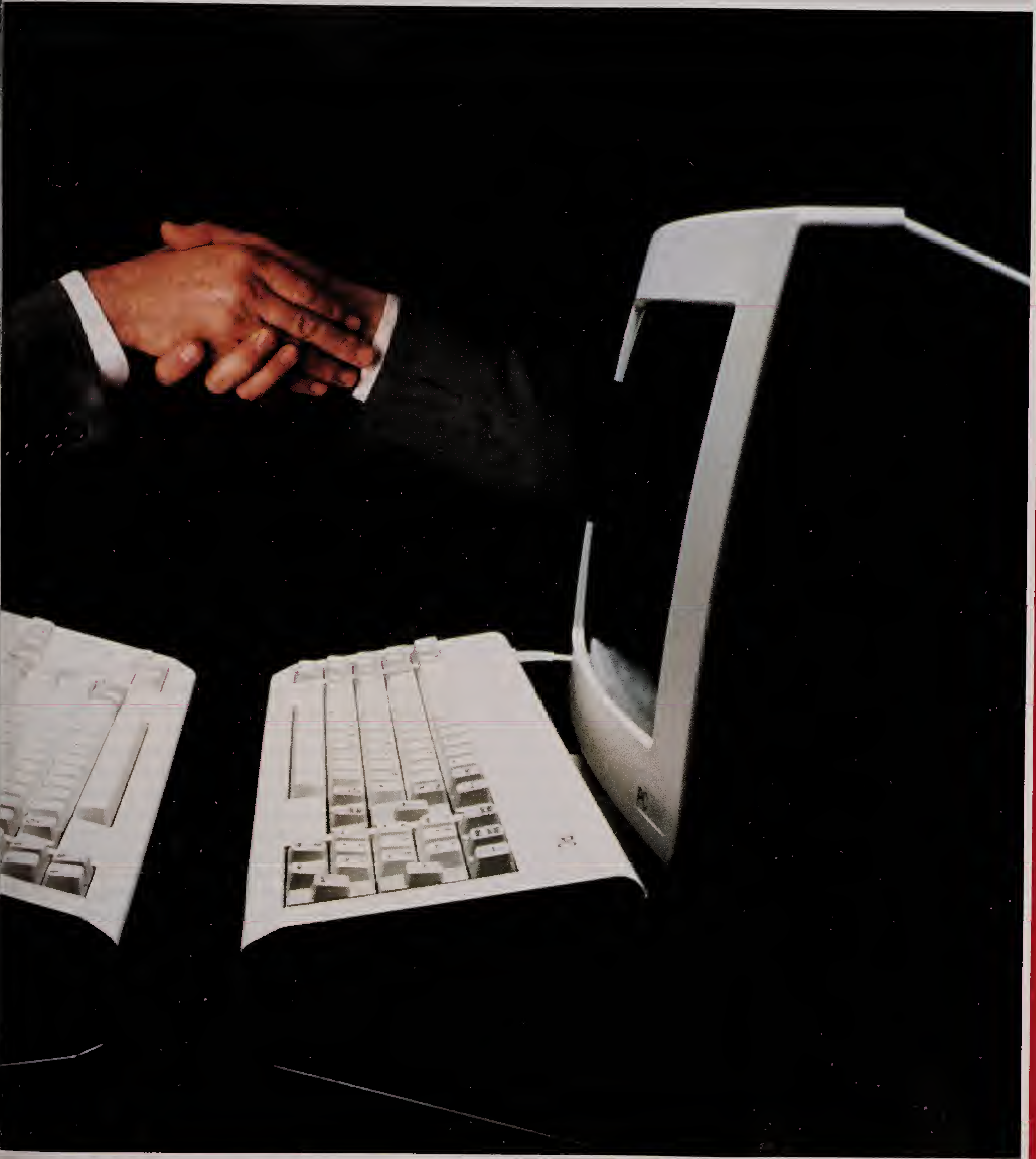

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up-to-date and accessible to all users. He is also now assembling a quality assurance group to review software before it is installed on the network and confirm that applications are kept current in all installations.

These efforts are costly to undertake and tedious to implement because of the technical issues involved and the complex organizational structures that need to be created. Dugger said that it took three years to get the data administration group fully operational, and he expects the quality assurance unit to take almost as long to establish. Eventually, the two groups will account for 15 percent of the central IS staff, Dugger predicted.

Of Carrots and Sticks

CIOs resort to a mixed bag of inducements to get their minions on board the distributed computing bandwagon

Mainframe IS shops have not turned into sources of distributed computing wizardry overnight. CIOs who have managed the transition say it takes cultivation, cajolery and sometimes plain old coercion to get traditional IS developers and analysts into the right mind-set.

Roger Brinkmeier, vice president of computer services at Journal/Sentinel Inc. of Milwaukee, is a cultivator. He has increased his staff training outlays sixfold over the past several years "in order to make our people more proficient and be more up-to-date technologically." The money is spent for refresher courses, conferences, seminars and similar undertakings that are intended to show Journal/Sentinel's mainframe veterans how to thrive in the distributed mini-and-microcomputer world. Until the company began its architectural transformation, there had been relatively little investment in in-service training, Brinkmeier said, so the increased expenditure "is a remarkable change for us."

It has often been the developers, rather than the users, who have expressed the greatest fear of change. Jon Hertzog, deputy vice president of computer IS at the Santa Monica, Calif.-based RAND research and development firm, turned to cajolery when he decided to move a major statistical system from the corporate mainframe to a distributed Unix network. Hertzog identified the most receptive developers in that unit and gave them new high-powered workstations to experiment with. Seduced by the advantages of the new platform, these developers began to work on the system migration. Soon the others joined in, their fears allayed by watching the experimenters. "You have to keep that strategy to yourself, [but] you can get them to buy in," he said.

When education and enticement fail, CIOs have used the sheer weight of authority to coerce their staff members to move from a centralized to a distributed IT perspective. "I've said to my group, 'This is the way we're going,' and relied on them to make the adjustments," said Jim Newman, director of information systems for Precision Castparts Corp. of Portland, Ore. "That is probably the only time I have gotten autocratic." Newman has committed Precision to a distributed architecture and a dispersed organization where virtually all IS staffers will soon work directly for line managers. "There may be some casualties," he said, "but they'll move on to another mainframe shop." *–P. Konstadt*

While the process of adapting to distributed computing has pressed CIOs to change the scale and scope of their IS infrastructures, it has also driven them to redefine IS's existing organizational relationships with users. Typical arrangements now include joint IS-end user decision-making on major questions and shared responsibility for routine matters. One result is that neither IS nor users have clear jurisdiction over distributed resources, and important issues sometimes slip between the cracks. Another is that many IS organizational boundaries are in what seems like permanent flux.

The shift to distributed computing dissolves once-clear organizational relationships and often leaves no obvious alternative, according to Marvin Ehlers, the vice president of IS at MidCon Corp., a natural-gas pipeline company based in the Chicago suburb of Lombard, Ill.

Ehlers' organization currently employs LAN managers at each of MidCon's geographically dispersed sites. They assure that network security and integrity are maintained, and they oversee locally used applications, equipment and similar administrative matters. Security and integrity are regulated by corporate policy, while local matters are settled by the LAN managers and their users with little or no central IS governance.

"We're still learning," Ehlers said. "We'll have to take it a step at a time." MidCon's IS department once asserted substantial control over LANS and full authority over LAN managers. In the move toward distributed computing, Ehlers has ceded most LAN policy direction to users but kept LAN managers within the IS organizational chart. That matrix of authority has created an uncomfortable ambiguity, and MidCon has "begun thinking about handing out full responsibility [to the users]," Ehlers said.

Placing a complex system under complete user authority can sometimes come back to haunt a CIO. Just ask Roger Brinkmeier, vice president of computer services at the Journal/Sentinel Inc. of Milwaukee. He installed a new digital telephone system in

1984. Once the system was brought up, Brinkmeier turned everything over to an office administrator. Hardware was well cared for over the years, but software wasn't. The administrator assumed that the system's general character was—like other office machines—basically unchangeable. When the system started operating painfully short of corporate needs, a general clamor forced Brinkmeier to retake control. The IS unit is now managing the needed software upgrades, and he has put supervision of all distributed systems under a newly created joint project management arrangement.

Joint decision-making and shared systems governance seem to be successful management strategies for making many judgments in distributed computing environments. But countless smaller issues also plague the IS-end user relationship, and for those CIOs have found that they cannot dictate every detail, only shape and guide the choices.

That is how Jon Hertzog manages the process of directing desktop computer buying in his large, technically sophisticated service organization. Hertzog is deputy vice president of computer IS for RAND, a research and development firm in Santa Monica, Calif., which has a long-established distributed network and a community of users who have disparate desktop requirements. Hertzog said he would have preferred a distributed system in which all desktop machines worked under a single operating system and dialect. "But with the diverse set of folks I serve . . . I have to allow the staff to choose the machines they think they need, within some constraints." Essentially, that means that users can buy machines from any of the widely available classes of desktop computers as long as those machines support communications utilities that are compatible with RAND corporate network standards.

Software control raises similar issues, and many organizations have adopted the same tactic: using corporate standards to shape choice and preserve some user options. But even the best-drawn software standards and policies cannot force users to be rigorous, according to MidCon's Ehlers. MidCon's financial analysts, operations managers and supply forecasters rely heavily on Lotus 1-2-3 for organizing and communicating their supply-and-demand data. With hundreds of individuals separated by thousands of miles, not everyone is working with the same version of the same Lotus release. As a result, users find themselves with files that they or their electronic correspondents cannot read. Ehlers hears the complaints of frustrated users and shrugs them off. "With power over their own systems goes responsibility, [so] they have an obligation to recognize that they may not be on compatible releases," he said. "I don't think that central MIS has or wants the authority to monitor or control that tightly. We can't think for everybody."

Empowering the users of new distributed systems often means teaching them how to use their new IS powers effectively. In many companies there is no one outside IS with the facility to manage such technical training for users; in some, CIOs have accepted the burden, not only by providing services, but by altering IS job descriptions and retraining IS staff to change the skills mix of the department (see related story, Page 68).

As the IS director for Ball Corp.'s metal container division in Westminster, Colo., Louis Baptist identified IS's need for "people skills" when his organization cut the data umbilical cord between the headquarters mainframe and the factories' control systems. The new distributed manufacturing applications they were installing had altered most processes in the company's factories and touched virtually all jobs and functional

CIO DISTRIBUTED COMPUTING SURVEY

Cultural and Organizational Barriers

End Users Will Need Substantial Training	63%
IS Staff Will Need Substantial Training	58
Senior Management Is Skeptical	31
IS Managers Risk Losing Control of Computing Function	23

Other frequently cited problems included resistance from end users (20 percent), IS staff (15 percent) and external customers, suppliers and other trading partners (6 percent).

CIO DISTRIBUTED COMPUTING SURVEY

Technological and Financial Barriers

Lack of Off-the-Shelf Software	52%
Threat to Database Integrity	46
High Cost	37
Increased Risk of System Crashes	31

A number of respondents also cited a lack of common standards as a major barrier to distributed computing.

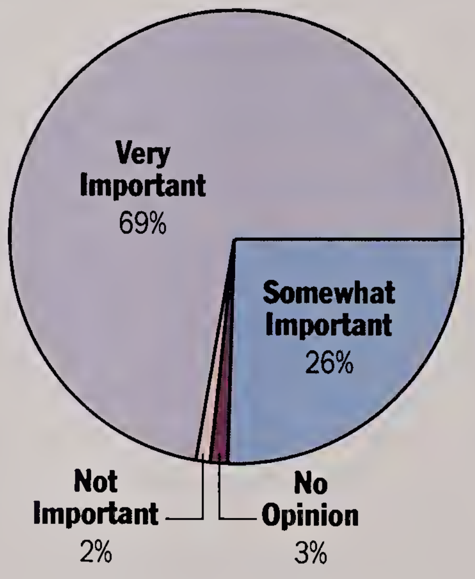
areas. To be sure that the changes went smoothly, Baptist said he and his staff “spent quite a lot of time in the plants, interacting with plant people.” As a result, he said, users feel a strong sense of ownership over the new technology, and the changeover is widely viewed as successful.

Baptist noted that such an effort requires skills not often found in traditional mainframe IS shops. Getting those skills called for changes in Ball Corp.’s hiring policies, not just retraining. “The people I hire are very good at [working with users], and they enjoy that aspect of the work,” he said.

The broad organizational changes that accompany distributed computing systems have reshaped some perennial corporate financial struggles by creating new opportunities to save money and new requirements to spend it. Senior managers and end users often favor distributed solutions because they appear on the surface to be less costly, but the eventual savings are often smaller than was first believed. “They always focus on the hardware component, which is the smallest part of the cost,” said RAND’s Hertzog. Smaller computers are far cheaper than large ones when compared only on the basis of their cost per unit of raw processing power or data storage space, Hertzog said. The loss-leader ads in daily newspapers for stripped-down hobbyists’ PCs make unknowledgeable executives think the price gap is even larger, he added.

CIO DISTRIBUTED COMPUTING SURVEY

Involvement of Non-IS Executives in the Decision-Making Process



Nearly half (46 percent) of respondents who had decided in favor of distributed computing said that the general manager within a business unit was the driving force behind that move. This was more than twice the number of those who cited the CEO (21 percent), the COO or the CFO (17 percent each).

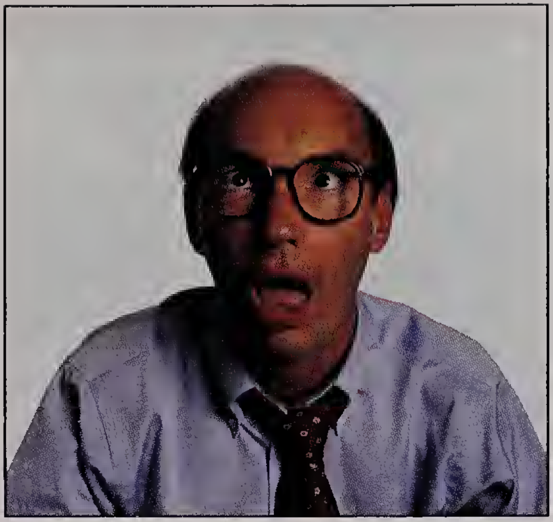
To overcome such misperceptions, CIOs point out that distributed computing requires substantial outlays for networking, telecommunications, peripheral equipment, dispersed maintenance, LAN management (see “Micro Evolution,” Page 72), applications management and training. The true benefit of the architecture is in the new powers it unleashes. “When you take into account all of the new functions that make users more productive, it becomes less expensive” than mainframe computing, according to Tennessee’s Dugger. “And we have seen some departments able to significantly reduce their head counts,” he added.

In some organizations, users now own and pay for their desktop computers and local peripherals outright. As a result, those systems are no longer tallied as a part of the corporate information outlay. Some CIOs worry that this will conceal from senior management the impact of information systems on company operations. Others acquiesce because their companies are committed to giving profit center managers direct control over local costs, even though that cloaks the true scale of corporatewide expenditures on IT. “Those who think about it are uncomfortable because [senior executives] probably don’t really comprehend how much [cost] is outside the IT budget,” said MidCon’s Ehlers. “I don’t know any good way to solve the problem, because every set of conditions, every set of personalities, is different.”

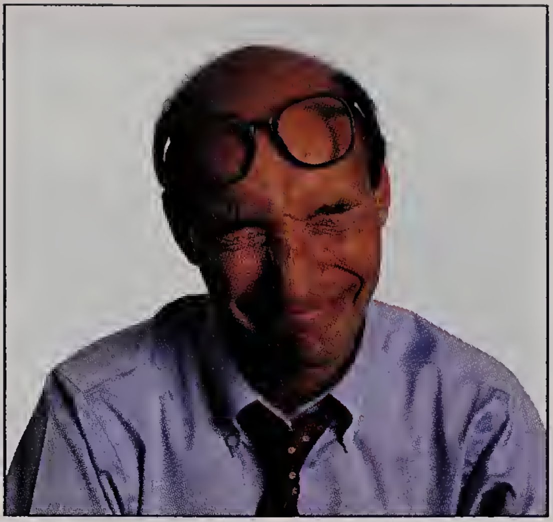
The story of the organizational transition to distributed computing is dominated by tales of technologists adapting to institutionalized uncertainty and ambiguity. Managing uncertainty and ambiguity has always been the job of top executives; it distinguishes the upper levels of the corporate hierarchy from those where the responsibilities are more firmly defined. That line is now being crossed more often by CIOs as their information organizations shift to distributed architectures. Facing that transition may have seemed daunting at first for information executives like Precision Castparts’ Newman, but now he finds it stimulating. Newman is midway through a process that will distribute his company’s information architecture and almost completely disperse the central IS resource. As a result, his corporate role is being transformed from day-to-day manager to strategic thinker.

“I’m feeling my way, [but] it’s a new adventure for me. After almost 30 years, [I’ve] got excitement again.”

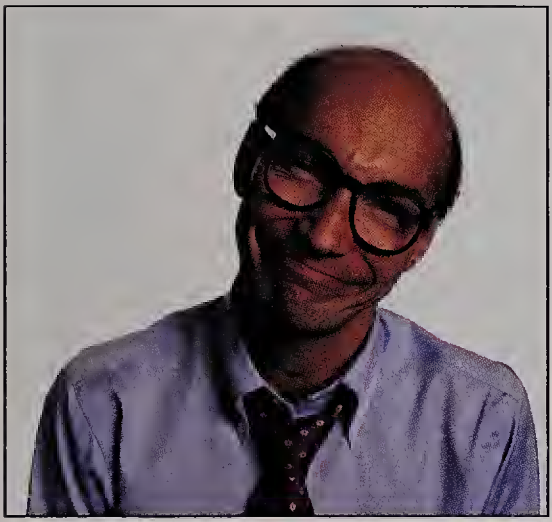
"Hello Mike? What does hard disk failure mean anyway?"



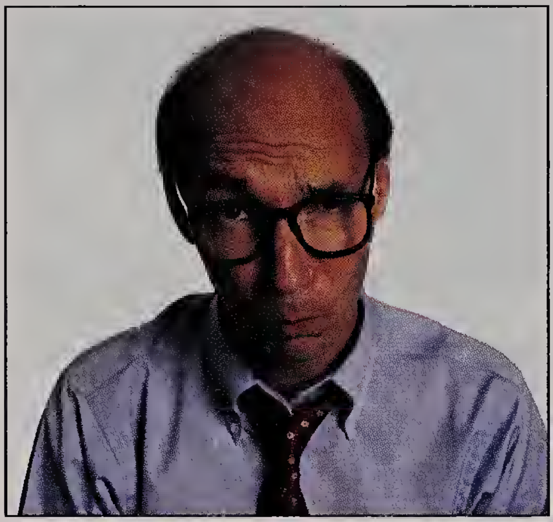
"Mike, we're spending a fortune on these PCs—where is all this money going?!!"



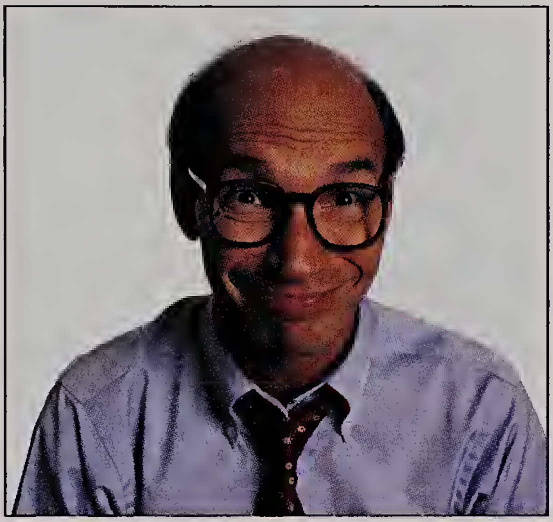
"Hi Mike, can you help me? I can't get on the network."



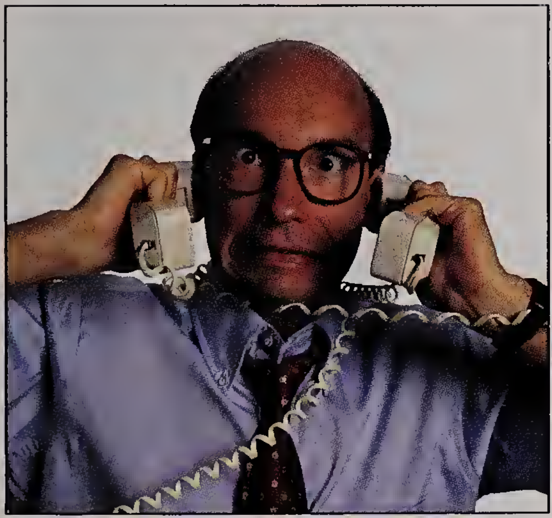
"I have some questions about this DOS stuff. Gotta minute?"



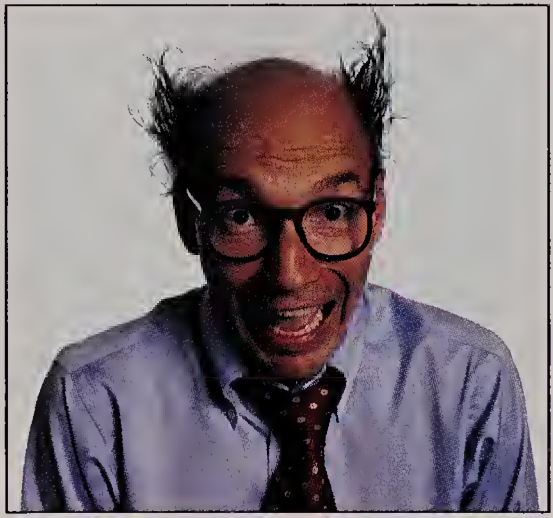
"Quick Mike, I desperately need a color monitor for a big presentation to our CEO!!"



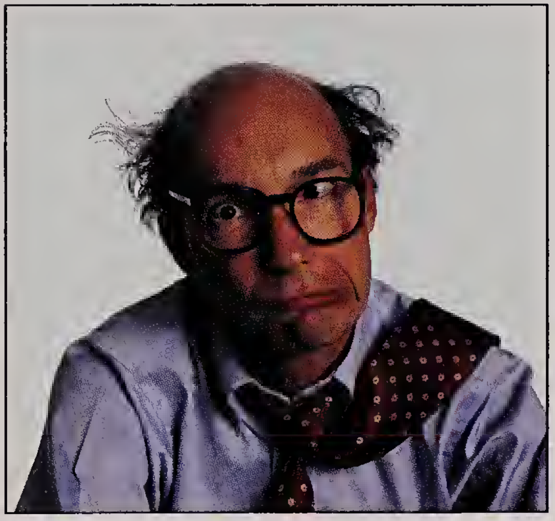
"Hello Mike, sorry, I forgot my password. Again."



"How come they got it and we didn't get it, huh Mike? What's the deal?"



"Mike, I'd like a summary of exactly what you and your people do all day on my desk by noon tomorrow."



"Yo Mike, there's some smoke coming out of the side and this big, loud buzzer noise...Mike? Hello, Mike?!"

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THE LAY OF THE LANS

Micro Evolution

Today's LAN environments have reached a higher state of being than their strictly departmental forerunners. In turn, they require increasingly complex management structures that often affect the entire IS kingdom.

BY LESLIE GOFF

In a very short time, the local area network has evolved from being a convenient resource-sharing scheme to being the carrier of mission-critical applications supporting a company's business plan. But for CIOs and their networking staffs, managing LANs is creating headaches that were long ago eliminated from the mainframe world.

LAN environments run the gamut from stand-alone departmental networks to geographically dispersed LANs linked together via an Ethernet backbone or a wide area token ring. These wide area networks are often hooked back into a remote data center. But for all the benefits of using these higher forms of LANs instead of mainframes—increased processing efficiencies, the distribution of information to all levels in the organization and reduced long-term costs—CIOs complain that they present the same problems that mainframes caused 10 years ago but that they lack equivalent management mechanisms. Moreover, delegating responsibility for the LANs may require a restructuring of the IS organization and procedures. Delivering corporate applications and data in a distributed environment demands corporate control and support to establish standards for hardware and software, operating procedures, application development and end-user services.

"Managing LANs, in essence, is like managing a large computer system that just happens to be in lots of places," said Jay Hamann, vice president of MIS at Schreiber Foods Inc., a cheese processor in Green Bay, Wis. "It's important that we understand [that LAN environments] are like a mainframe and provide the necessary management structure around them."

That isn't to say that CIOs long for a return to a mainframe-controlled IS world. They are simply being realistic about the challenges facing them in the LAN environment. Matthew Cain, a senior research analyst in desktop computing services at the

JAY HAMANN: *"Managing LANs is like managing a large computer system that just happens to be in lots of places."*

PHOTO BY JAMES SCHNEPF

META Group in Westport, Conn., said that "as IS tries to corral the LANs around the organization, they bring to [the process] a centralized perspective, which essentially is a mainframe perspective. . . . They are looking for the same [management controls] that they have in the mainframe environment, which I think is totally valid."

CIOs lament that the dearth of comprehensive tools for implementing, monitoring and troubleshooting LANs is at the root of most LAN management problems. "I have a bundle of concerns, and any one of them is bad enough in itself," said Marvin Ehlers, vice president of information systems at MidCon Corp., a wholly owned subsidiary of Occidental Petroleum based in Lombard, Ill., that operates an interstate natural gas pipeline. "LANs are still an adolescent form of technology."

Troubleshooting on a geographically distributed network becomes a cat-and-mouse game between the support person and the hundreds of bridges, routers and other devices on the network. Monitoring usage for chargeback purposes is nearly impossible.

I'm sitting in a

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that the moon

however, the PBX

company might

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set up to detect

System and fix

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corner office on a round planet and I'm thinking about

last night he looked at the crescent moon above our

"Daddy, broken moon, broken moon." And I told him

would be fixed soon by a silent and unseen hand;

that I bought for the corporation from some unknown

not be fixed any time soon at all, and my little boy who

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Network security and data backup are ad hoc efforts. Some users are waiting in the wings for tools to address these problems, making do the best they can in the meantime, while others simply cannot wait (see related story, Page 77).

For Stephen Yates, the CIO at Brown & Root Inc., a Houston-based engineering and construction firm whose credits include designing and building the first NutraSweet plant as well as the largest oil refinery in Kuwait, troubleshooting the 65 LANs his company operates around the world is a top concern. Both of the company's mission-critical applications—computer-aided design and the corporate financial system—run on the LANs, which are tied into an Ethernet backbone. "If a LAN goes down, we're out of business," he said. "When we have network problems, I get a lot of complaints."

MARVIN EHLERS: *"It's difficult to find the source of the problem and fix it in the time needed today."*

PHOTO BY NEIL MACDONALD

Yates said that one hour of downtime is considered major. It usually takes 10 to 20 minutes to identify and work around most network outages. Currently, Brown & Root is using concentrators from Synoptics Communications Inc. of Santa Clara, Calif., to troubleshoot the LANs because the concentrators run over existing phone lines, Yates said.

"[The concentrators] have some pretty good smarts about saying, 'This device is the problem' " on a LAN, he added, but the problems are not so clear-cut when they involve a router—a network traffic cop—or a gateway into the wide area network. "All of those boxes are made by different companies with different technologies. If one takes a hiccup, it's hard to tell where it is."

For all the benefits of using these higher forms of LANs instead of mainframes, CIOs complain that they present the same problems that mainframes caused 10 years ago but that they lack equivalent management mechanisms.

The sheer number of vendors in the LAN management market is a testament to the difficulties of troubleshooting large networks. MidCon's Ehlers said he had identified between 25 and 50 vendors whose products are used on the company's LANs and are the potential sources of problems.

"It's difficult to find the source of the problem and fix it in the time needed today," he said. "We're kind of our own worst enemy because we're trying to help users and hook them up to the networks, but the more complicated the network is, the more difficult it is to manage."

Calculating usage chargeback is another mainframe ability CIOs say they would like to see on LANs. On a LAN, the server acts essentially as a small mainframe. The difference is that mainframe tools can monitor how quickly resources such as disk space and memory are being used up. Such metrics are not yet available for LAN servers, and "if you can't measure it, you can't manage it," Ehlers said. When the resources run out, however, users clamor for more.

"The problem is, how do we pay for this?" Yates asked. His answer: User departments rent their equipment from Brown & Root's IS organization. "That way, if they want to

The LAN Toolkit

While individual products do exist, information executives long for the integrated package that will do it all

CIOs complain that most of their LAN management concerns stem from the paucity of comprehensive tools to troubleshoot, monitor, configure and measure LAN systems.

Tools that will address key areas of LAN management are coming, however. Todd Dagres, director of communications research and consulting for the Yankee Group Inc., a high-tech market-research firm in Boston, said users have a "hierarchy of needs" that includes problem management, configuration management, performance management, security and accounting (measuring usage). Vendors will meet these needs as customers advance through each stage of LAN management.

"Users are asking loudest for products at the lowest level of the hierarchy," Dagres said. "Once they get problem management under control, they'll start worrying about configuration management" and on up through the hierarchy. "And that is the way vendors develop the products: They build what users are going to buy."

Ultimately, these individual pieces of the puzzle will be integrated into the major LAN operating systems, where they will act as comprehensive intelligent hubs. For some users, however, the needs are too urgent to wait.

Dale Terrell, executive vice president of information systems at Security Pacific Automation Co. in Los Angeles, the data processing subsidiary of Security Pacific Corp., oversees some 200 LANs in five states supporting customer service, sales and marketing, bank branches, software development and an executive information system.

"We had to design and build a few remote network management tools ourselves because the ones on the market are not comprehensive enough or are too expensive," Terrell said.

With their custom-built tools, Terrell's staff can monitor LAN performance 24 hours a day from one facility. The company also developed a system to centrally control and distribute software releases.

Security Pacific's business needs were such that it was critical to develop tools in-house rather than to wait for the release of effective commercial products. "We can't put much on the back burner waiting for tools," Terrell explained. "There is always a business case strong enough to move ahead."

–L. Goff

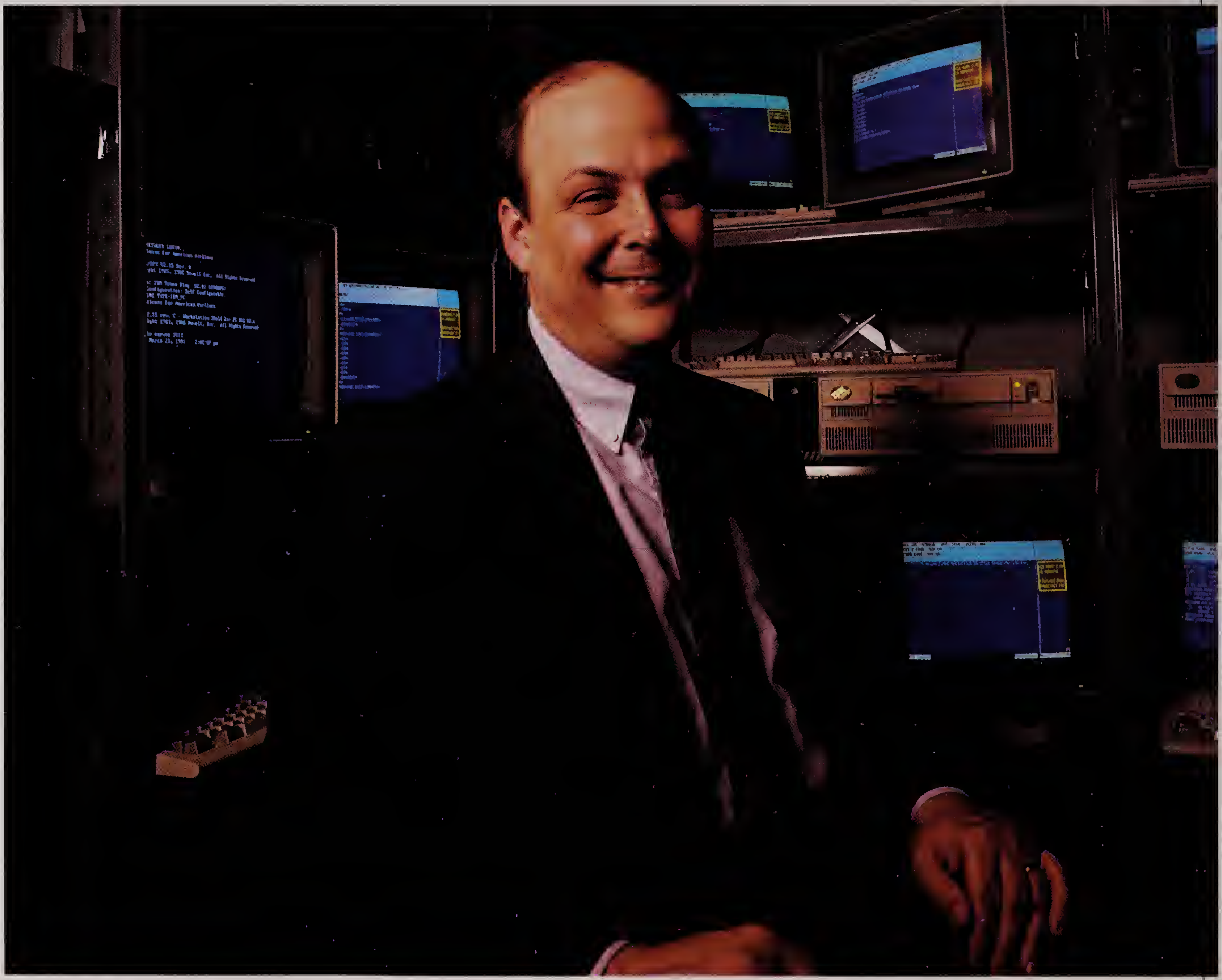
CIOs lament that the dearth of comprehensive tools for implementing, monitoring and troubleshooting LANs is at the root of most LAN management problems.

keep growing, we just put in bigger boxes at bigger [fees]."

Until better LAN tools are available, CIOs can overcome the inefficiencies of the LAN environment by fostering a dedicated LAN support group comprising individuals from across the organization. "With traditional IS support you needed depth of knowledge," said the META Group's Cain. "For LANs you need breadth of knowledge, . . . and you rarely find that in organizations today."

Current LAN support strategies are often piecemeal efforts with LAN responsibility divided among various support groups. For instance, at Burroughs Wellcome, a pharmaceuticals outfit based in Research Triangle Park, N.C., LAN responsibility is split up among hardware maintenance, software support, application development and long-term network development. Each of these specialized groups reports to central IS, according to Jonathan Petersen, network services administrator.

But it can be difficult to "strategically plan for LANs when the responsibility is spread so thinly throughout the organization," Cain noted. He expects a move toward interdisciplinary LAN support teams made up of cross-trained personnel pulled together from such areas as mainframe application develop-



BARRY ROGERS *is cross-training office managers and microcomputer support personnel to support future LAN development.*

STEPHEN YATES: *"If a LAN goes down, we're out of business."*

ment, microcomputer support, data communications and end-user business units. (Cross-training involves putting individuals with various skills into one group where they are trained in each other's disciplines.) Petersen said Burroughs Wellcome is evaluating cross-training personnel and restructuring its LAN support under one umbrella. "I think a dedicated LAN support group would be better," he said. "The more we feel we're part of a team, the more we'll play together."

IVI Travel, a national corporate travel agency based in Northbrook, Ill., is cross-training office managers and microcomputer support personnel to support future LAN development. The agency recently began tying its 120 offices into its corporate minicomputer so travel agents can access a central database of hotel availability and client rates.

Barry Rogers, IVI's vice president of information resources, said that most of IVI's offices have LANs that link via gateways into one of the airline reservation systems (Sabre, Apollo or PARS); many of the larger offices have such links into more than one system. A LAN administrator—usually the IVI client service manager—is trained by the airlines to configure and troubleshoot the LAN and serves as the first line of defense for users. Within the IS organization, a Micro Systems department handles LAN application development and problems that are too big for the LAN administrator.

"We have a person in [Micro Systems] who is receiving very technical training in LAN management" and who will act as a go-

PHOTO LEFT BY NEIL MACDONALD. PHOTO RIGHT BY CINDY CHARLES

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LAN Management Issues

	AGREE	DISAGREE
The departments using LANs do not make full use of their capability	82%	13%
I am looking for new ways to leverage the power of our LANs	77	19
The role of the LAN manager is becoming more pivotal to the strategic direction of computing in our company	73	25
Troubleshooting LANs off our WANs is difficult	63	30
Creating effective, easily used interfaces between LANs and corporatewide systems is difficult	59	35
Setting and administering responsibility for LANs is difficult	57	40
The most senior LAN manager reports to me	54	41
It is difficult to establish and enforce satisfactory standards	52	45
Information kept on departmental LAN servers is difficult to access, redundant or inaccurate	44	53
LANs are too slow for the WAN technology I wish to use	33	62
LANs created by users are incompatible with corporate standards	30	65
LANs frequently crash	27	70
I am working toward transferring control of LANs from end users to the IS department	24	71
I am concerned about finding an optimal role for the CIO in LAN management	22	75
The departments using LANs are putting too much of a computing burden on the servers	20	75
LANs are too slow for the WAN technology we now use	15	84

between for the LAN administrator and IS, Rogers said. "I anticipate we'll have to expand that function as we expand our installations."

As the company links the individual office LANs into the corporate mini, Rogers' staff and the LAN administrators will be able to coordinate and integrate their activities. But in most companies end users are spending 10 to 15 percent of their time on routine departmental LAN management and administration because most companies lack "the commitment to train people and bring them up through the organization," according to Todd Dagres, director of communications research and consulting at the Yankee Group Inc., a high-tech market research firm in Boston. For example, a network manager in a large manufacturing concern with international LANs noted that the company "does not have time to do much cross-training." Although cross-training makes logical sense, if not managed properly it can ignite rivalries within the IS organization. Cain said that over time, however, resisters will "see that [cross-training] will extend their careers and make them more valuable to the organization."

> **"We're kind of our own worst enemy because we're trying to help users and hook them up to the networks, but the more complicated the network is, the more difficult it is to manage."**
>
> *–Marvin Ehlers*

Petersen of Burroughs Wellcome said the degree of specialization of its myriad support groups has resulted in past turf battles. Reorganizing into a dedicated LAN support group, he believes, "should make them feel like they are on their own turf—not someone else's."

Like any other technology, LANs will continue to evolve in sophistication and capacity. CIOs' LAN savvy will evolve in a parallel fashion, but in the meantime, networks will fail, troubleshooting will be tricky and support organizations will struggle to put the right people in the right areas. "It takes a fair amount of learning if you're going to use [information technology] for anything useful," observed Schreiber Foods' Hamann. "The same mentality goes into saying, 'I'm not going to use my mainframe anymore; I'm going to use my LAN.' Well it may be a little easier, but really you still have many of the same problems."

Leslie Goff is a freelance writer based in New York.

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STANDARD PRACTICES

The ABCs of TCP/IP (and FDDI and SNMP...)

Understanding communications standards is a crucial yet often baffling part of CIOs' jobs these days, so we asked a few pundits and practitioners to help shed some light on the subject

BY ALLAN E. ALTER

Given the importance of communications standards to distributed computing, and given the state of confusion standards tend to bring about for many IS professionals, we thought it might be helpful to round up the opinions of some experts, vendors and veteran practitioners. While we may still be a long way from open everything, a good way to get there may be through the kind of open discussion you will find below.

How should companies go about selecting standards?

James S. Marston
Senior vice president and CIO of American President Companies Ltd., Oakland, Calif.

At American President, we have a formal systems engineering group that is responsible for the analysis of all future technologies, their selection, and building integration plans to bring in those technologies. They have responsibility for determining the standards by which we operate.

Bud Huber
Chairman of the User Alliance for Open Systems (formerly known as the Houston 30) and senior consultant at Hughes Aircraft Co., Los Angeles

At Hughes we select standards based on a hierarchy of who creates them. We prefer international standards: ISO, or CCITT. The second category comprises national standards such as ANSI or IEEE. Down from there are de facto standards, such as TCP/IP, followed by industry-specific standards. The lowest would be proprietary, interest-specific standards.

PHOTO BY RALPH MERCER

Peter G.W. Keen

Executive director of the International Center for Information Technologies, Washington

There is no open-systems tooth fairy. People have to look at standards by implementation, not by definition. The standards-by-definition game claims that Unix is open and SNA is proprietary. But dominant de facto standards, like SNA and MS-DOS, are open even though they're proprietary, whereas no one version of Unix has yet prevailed.

Two other forces that create standards in implementation are powerful groups of cooperative users and vendors who agree to use one of the vendor's implementations as a base. Many of the most powerful standards are not coming from the standards organizations. Cooperative vendors are driving EDI. Cooperating users plus cooperating vendors made TCP/IP a more open, effective and efficient standard than OSI.

If you look at the state of standards within the context of a four-stage architectural plan, at the moment we're at stage one, which is multivendor chaos. Somewhere in the distance is stage four: open everything. The problem is getting from chaos to open everything. You need a target architecture based on standards in implementation, so as new standards come in you can move to open everything. But to get there you have to go through the toughest stage: triage architecture, where you kick out some of the vendors, bring in the systems integrators and rebuild.

Remember, the products, services, alliances and reorganizations your company will be able to make depend on the choices of standards. Those are business issues, not technology issues.

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Which standards are key for successful distributed computing?

Les Sitzes
Director of the communications information group at Datapro Research Group, Delran, N.J.

There are a number that are important: ISO's DIS 10026 for distributed transaction processing; IBM's SAA, LU6.2 and APPN; Unix System V's "Streams"; the Open Software Foundation's Distributed Computing Environment; and distributed database management standards being developed by several ANSI subcommittees and by the OSI DataBase task group. Also important are remote procedure call, or RPC, software, and application programming interfaces.

These standards provide the architecture that will most likely be supporting distributed applications in the near term.

Robert W. Stearns
Vice president of corporate marketing for the Codex Corp., Mansfield, Mass.

Start out with the seven-layer OSI model for communications, then look for available standards within each layer.

For networking, standards like X.25 and the evolving technologies of frame relay and fast packet are very important. In the modem arena, V.32bis. In local area networking, TCP/IP and ultimately OSI. In the network management arena, we think SNMP and OSI standards are very important.

These are very real standards that solve problems well.

Roger M. Cooper
Deputy administrator for management at the Farmers Home Administration of the U.S. Department of Agriculture, Washington

The strategic thing in distributed processing is choosing a database, because that drives everything else. SQL is really important. We chose to use Oracle, which uses SQL, because it ran on all platforms under different operating standards.

Other standards are Sun's Network File System standard, TCP/IP at the current state of the art and OSI in the future, X.400 for electronic mail, and X.500 for E-mail directory standards.

Lindsey C. Lawrence
President and COO of BayBanks Systems Inc., Waltham, Mass.

We are an IBM SNA shop, but we think that OSI is key. The flexibility we gain is what excites us about standards. If several vendors support a standard, then we can choose which products make more sense for us. If we embrace a proprietary standard, we'd be stuck with one vendor for better or worse. OSI is the framework for the eventual achievement of worldwide standards that major vendors all support. We also are looking at user interface standards and database interface standards.

Paul W. Bayliss
Market planning and management vice president of Bellcore Interface and Standards for AT&T Network Systems, Holmdel, N.J.

The IEEE 802 activities are key. Certainly the array of standards being set under ISDN, OSI and Unix.

Marston: We're looking at the standards in the X-Windows area. We are looking at open systems environments that will allow us to operate LANs and interconnect LANs through WANs, and related standards in routers and frame relays.

> **There is no open-systems tooth fairy. People have to look at standards by implementation, not by definition.**
>
> *–Peter G.W. Keen*

Huber: All of them. Distributed computing requires the ability to do online transaction processing, file transfers, electronic document interchange, electronic mail, etc., and these in turn require an entire suite of standards from the lowest to the highest layers.

We do not have successful broad, multivendor-based distributed capability in the IT industry to date. That's what open systems are all about—trying to move the industry toward that capability.

What other communications standards are critical?

Marston: Our large global networks have become essentially an SNA network. We are using TCP/IP. I mentioned X-Windows, a Unix standard. We use Ethernet, Appletalk and token ring LANs. The ability to attach dissimilar devices and interface them to mainframe environments is of particular importance to us.

> **The formal committee process is lengthy, convoluted and difficult. As a result, vendors have started to focus on some common approaches that will make their products more attractive, without waiting for all their formal standards to be set.**
>
> *–James S. Marston*

Bayliss: ISDN will be important for voice and data communications. You have the new set of SONET standards for optical fiber-based networks.

There are a whole array of standards in the areas of advanced intelligent networks and metropolitan area networks used for interconnecting LANs. One set of standards to mention is Switched Multimegabit Data Service (SMDS), being worked out in IEEE 802.6. It's a set of standards for high-capacity systems, falling under metropolitan area standards. The Telecommunications Industry Association is setting standards for cellular communications.

Keen: The right target architecture will have the main IBM architecture: SNA. At the same time, you will have X.25. The X.25 architectures are now moving into frame relay, and that is very exciting. Frame relay is 10 times as fast. That means we can start taking X.25 architectures into high-performance data transfer.

The LAN target architecture may have to be a little vague, because we don't know the next generation of LAN-to-WAN connections. LAN standards are being driven by departmental needs, and WAN standards by corporate needs, and the two often don't mesh technically or politically.

X.400 is the most important standard to emerge in 10 years. It's the poor man's EDI. It's also one way of dealing with internal incompatibilities. You can link an incompatible finance system to an incompatible manufacturing system without having to rebuild. You can only do that for low-volume, simple messages, but it's an advantage over what we've got.

X12/Edifact will almost certainly be in it, since an open architecture has to include outsiders—customers and suppliers. When we talk about standards, we must include standards for doing business with other firms.

Another key standard is SQL. We don't know which of the major database management systems will emerge, but SQL gives us at least the standard interface.

I have a hunch that TCP/IP has won in the marketplace, regardless of what the OSI people have said. But that's only a hunch.

Sitzes: EDI, SONET, SMDS, B/ISDN, FDDI and frame relay are critical standards addressing high-bandwidth communications. The IEEE 802 series of standards provides the framework for LANs and MANs. It is key as we move toward MANs; the 802.6 MAN standard provides for the transport of voice, data and video.

TCP/IP is significant, as are Simple Network Management Protocol (SNMP), and OSI for integrated network management systems.

Which standards will no longer be significant for leading-edge companies in three to five years?

Bayliss: Maybe some of the lower-bandwidth standards. There will be a migration from proprietary interfaces as we move to open systems and recognized standards.

Huber: The trend is toward open systems. Any kind of interface or protocol standard that is based on proprietary systems will slowly—and that's an important word—fall into disuse and disrepair.

Peter G.W. Keen

Les Sitzes

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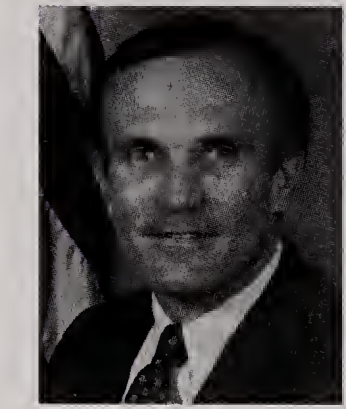
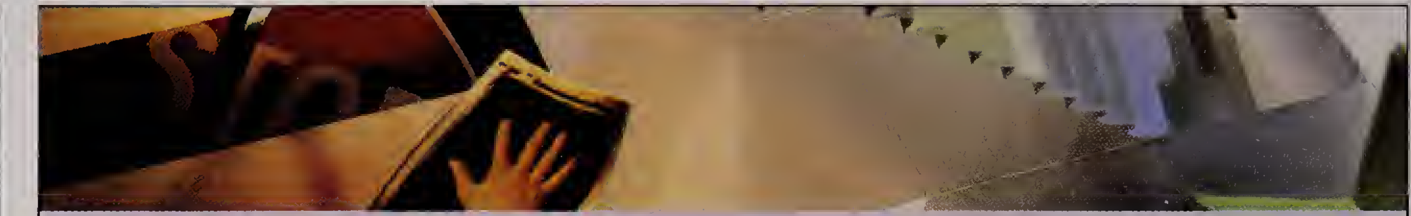


Roger M. Cooper



Getting into the Act

Information executives who are tired of sitting on the sidelines while the standards-setting game goes on can get involved in standards organizations and user groups

The following is a partial list of user and user-oriented organizations; for the committees that set standards, see the reference section beginning on Page 95.

Association of Data Communications Users Inc. (ADCU)
P.O. Box 20163
Bloomington, MN 55420
612 881-6803
Contact: Augie Blegen

CAM-I
1250 E. Copeland Rd.
Suite 500
Arlington, TX 76011
817 860-1654
Contact: Ben Kaminski

Canadian Interest Group on Open Systems (CIGOS)
c/o Canadian Standards Association
178 Rexdale Blvd.
Rexdale, Ontario M9W 1R3
416 747-2333
Contact: Colin Bardell

Corporation for Open Systems International (COS)
1750 Old Meadow Rd.,
Suite 400
McLean, VA 22102
703 883-2700
Contact: Mike Walter

COS user groups and their contacts:

- North American MAP/TOP Users Group
  Elizabeth Schrock/Tina Murray
- The User Alliance for Open Systems
  Elizabeth Schrock
- OSINET (a vendor/user group)
  Nancy Pierce

International Telecommunications Users Group
18 Westminster Palace Gardens
Artillery Row
London, SW1P 1RL
(011 44) 071 799-2446
Contact: George McKendrick

National Institute of Standards and Technology (NIST)
U.S. Dept. of Commerce
Room B-151,
Technology Building
Gaithersburg, MD 20899
Contact: Shirley Radack, 301 975-2833

NIST user groups and their contacts:

- The NIST Workshop for Implementors of OSI
  Tim Boland, 301 975-3608
- North American ISDN Users' Forum
  Dawn Hoffman, 301 975-2937
- Federal Open Systems Users' Council
  Allen Hankinson, 301 975-3290

Uniforum (for users of Unix)
2901 Tasman Dr.
Suite 201
Santa Clara, CA 95054
408 986-8840
Contact: Shirley Neve or Ralph Bartwell

SOURCES: CORPORATION FOR OPEN SYSTEMS INTERNATIONAL, DATAPRO RESEARCH AND THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Keen: Ethernet; it was a simple solution for simple networks. MS-DOS, ironically, even though it is so powerful now, because of the massive shift that's coming with more powerful workstations. I'm not sure about Windows, Unix and OS/2.

ISDN is totally out-of-date. The technology overtook it; users started adopting things that worked.

Sitzes: Those that do not support an "open" systems environment, including vendor-proprietary networking standards.

Cooper: The more proprietary standards like SNA. I think leading-edge folks will go toward the more generic standards like OSI.

Stearns: X.25 packet switching is beginning to become less important. The same will be true of TCP/IP in three to five years. I don't have a lot of faith in ISDN as a standard, now or in the future. And a variety of de facto standards like SNA are going to fall into less common use.

> **Standards are too technical. The confusing part is that the industry assumes that users want or need to know all the nitty-gritty details about standards. We don't. We shouldn't. But we have to in self-defense.**
>
> *–Bud Huber*

How are standards set in practice, and how is this different from the way they are set in theory?

Marston: The formal committee process is lengthy, convoluted and difficult. As a result, vendors have started to focus on some common approaches that will make their products more attractive, without waiting for all their formal standards to be set. There is an informal process, and it is moving much faster than the formal process could probably ever support.

Bayliss: We are entering a time where de facto and proprietary standards are becoming a thing of the past. As vendors, we have to make sure that as we develop new capabilities we do not get ahead of the standards. We try to keep our practical development work in pace with standards-setting activities.

Sitzes: Ad hoc industry standards such as SNMP are established more quickly than the long, drawn-out committee process. In practice, the market chooses what works.

Cooper: The theory is that we all agree, and then everybody conforms to the standard. That is not true. ISDN is an example of a standard that's been well thought out, but nobody is using it. OSI is suffering the same fate. It's not well defined. People are not using OSI as much as TCP/IP, because the products on TCP/IP are better.

What do you find most confusing about standards?

Marston: It's not that standards are confusing; it's more a lack of unified direction. There hasn't been any common industry thrust. Each manufacturer has pushed an area of primary importance for them.

Bayliss: There are as many different ideas on how to do them as there are people working in the field. Our objective is to keep standards to as small and simple a set as is reasonable.

Huber: Standards are too technical. The confusing part is that the IT industry assumes that users want or need to know all the nitty-gritty details about standards. We don't. We shouldn't. But we have to in self-defense.

Users haven't really taken charge of their destiny. They should state their requirements from a business perspective and then let the vendors create solutions.

Cooper: There's nobody in charge. There are lots of standards bodies, but the only thing that counts ultimately is market share.

Lawrence: Figuring out which of the standards being proposed are going to be real, and which the rest of the world won't adopt. It is particularly difficult because some standards are blessed by a standards-setting organization, and others are de facto standards. Figuring out which will be the really important ones is difficult. CIO

Lindsey C. Lawrence

Paul W. Bayliss

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POINT OF REFERENCE

A Communications Primer

Making Sense of the Distributed World

Distributed computing represents a new frontier for many readers of *CIO*. It has its own terminology, contains an alphanumeric soup of specifications and labels, and requires at least some understanding of that most confusing of areas, communications standards. This section, created with Datapro Research, a computer and communications information services provider in Delran, N.J., will help to untangle some of the more perplexing aspects for readers as they struggle to connect their companies' operations in the brave new world of distributed computing.

Included are a glossary; a breakdown of standards and standards-setting organizations; a list of job descriptions and salary ranges; a roundup of value-added network vendors; and listings of some of the more prominent distributed computing hardware, software and communications vendors.

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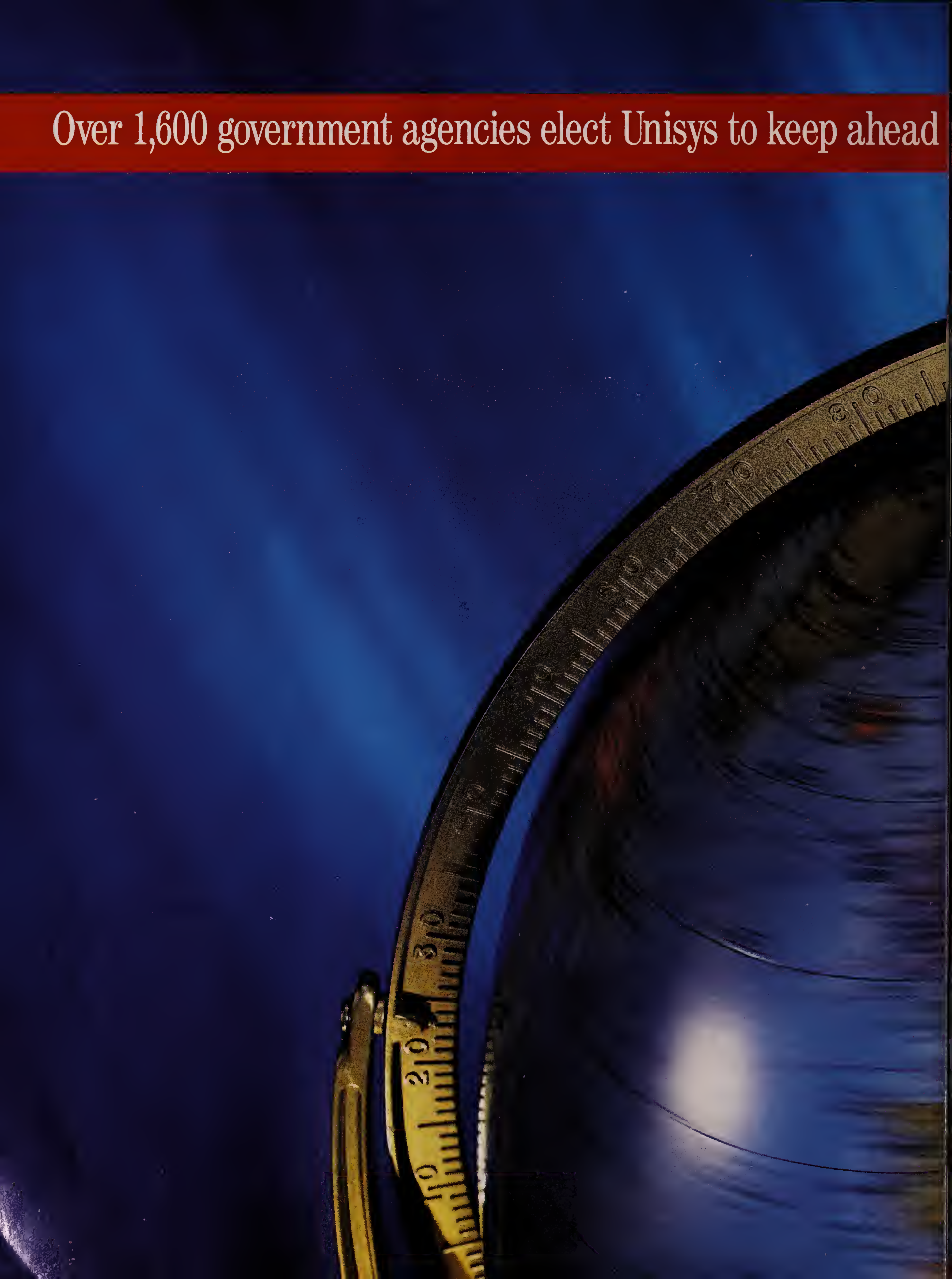
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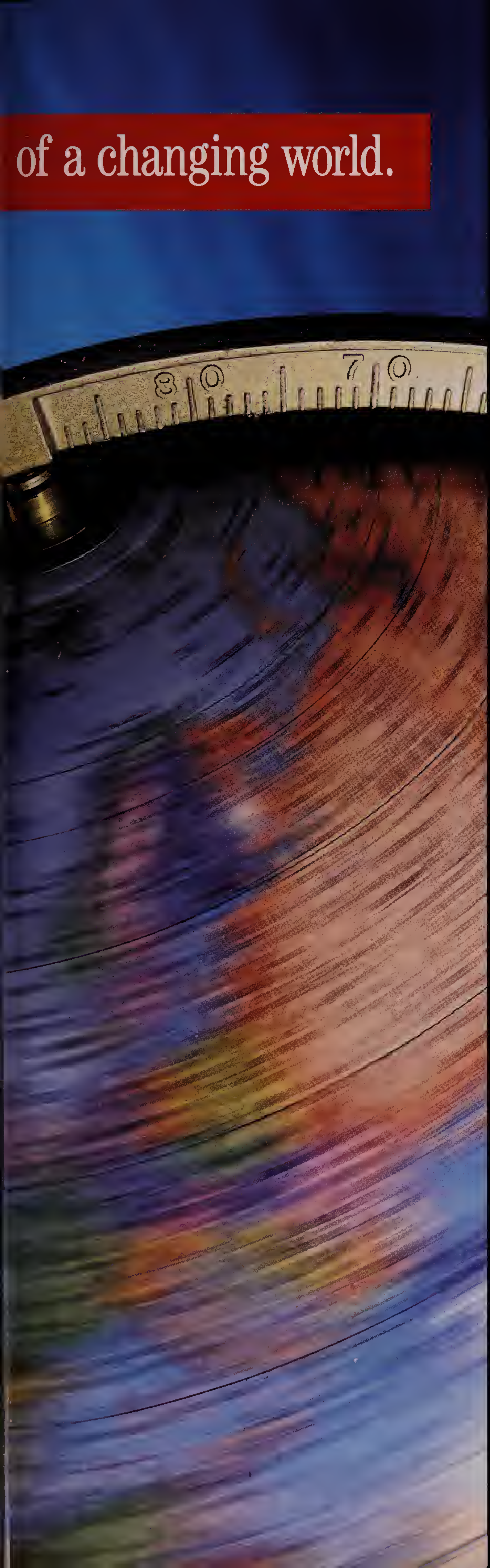
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Glossary

The telecom world is evolving at a mercurial pace. Witness the number of new terms (marked with asterisks) that have emerged since we put together last year's glossary.

***10Base-T:** A LAN standard recently developed by the IEEE 802.3 committee. It defines the specifications for 10-megabit per second Ethernet transmission over inexpensive, unshielded twisted-pair wire.

Asynchronous Transmission: Each information character, or sometimes each word or small block, is individually synchronized, usually by the use of start and stop elements.

Bandwidth: The range of frequencies, expressed in hertz (Hz), that can pass over a given transmission channel. The bandwidth determines the rate at which information can be transmitted through the circuit—the greater the bandwidth, the more information that can be sent in a given amount of time.

Bridge: A relatively simple device that passes data from one LAN segment to another without examining or altering the data. The bridged LAN segments must use the same protocol. Well-suited for centralized networks with a few high-bandwidth links.

Brouter: A bridge with minimal routing capabilities (see bridge, router). In general, a brouter can deliver least-cost routing; some can also deliver minimal load balancing.

***Cell Relay:** A packet switching technique that uses fixed-length packets, providing higher speeds and reduced processing costs.

Client/Server Model: In most cases, the "client" is a desktop computing device or program "served" by another networked computing device. Computers are integrated over the network by an application, which provides a single system image. The server can be a minicomputer, workstation or microcomputer with attached storage devices. A client can be served by multiple servers.

***Common Channel Signaling System Number 7 (CCSS7):** A CCITT-specified signaling protocol used in high-speed digital networks to provide communication between intelligent network nodes.

***Common Management Information Protocol (CMIP):** OSI's network management protocol (ISO 9596). CMIP is not yet widely available and is more expensive to implement than SNMP.

***Fast Packet Switching:** A generic term for improved packet switching technologies. Fast packet techniques feature less functionality than traditional X.25 packet switching for higher speeds and lower processing costs.

***Fiber Distributed Data Interface (FDDI):** A LAN standard specifying a LAN-to-LAN backbone for transmitting data at 100 megabits per second over fiber-optic media.

Fiber Optics: A technology that uses light as a digital information carrier. Glass-based fiber-optic cables occupy far less physical volume than conventional coaxial cables and wire pairs for an equivalent transmission capacity. The fibers are immune to electrical interference.

***Frame Relay:** Like X.25, frame relay is a network access method or user-to-network interface. Just as X.25 allows user access from remote locations to network packet switches, frame relay provides user access to a higher-speed network that is

Help Wanted

Telecom Job Specifications

TITLE	SALARY RANGE*	EXPERIENCE REQUIRED	JOB DESCRIPTION
Communications Director *large organization*	$56,100 to $90,900	12–15 years	Responsible for all voice/data plans, systems and operations. Supervises telecommunications staff.
Communications Manager *small/mid-sized organization*	$48,800 to $74,600	10–12 years	Same as above, but in a smaller organization with a smaller budget, fewer subordinates and less-complex systems and operations.
Data Network Operations Mgr.	$33,900 to $58,300	8–10 years	Supervises technology controllers and may be responsible for logistics as well as total network operations.
Senior Network Planner	$40,200 to $62,000	5–7 years	Uses advanced techniques (such as modeling), plans large and complex networks, and sometimes makes broad and detailed financial analyses.
Senior Data Communications Analyst	$39,800 to $59,700	6–8 years	Broad planning for major projects. Wide scope of equipment plans (detailed costs, traffic analysis) may be part of the function.
Senior Voice Analyst	$36,900 to $59,200	5–7 years	Manages projects of considerable complexity, cost and size; wide scope for evaluations and recommendations.

**These ranges take into account regional pay differentials and exclude the highest and lowest 25 percent. Some extrapolations and estimates have been made.*

SOURCE: DATAPRO RESEARCH 1990 TELECOMMUNICATIONS SALARY SURVEY & PERSONNEL RESOURCES INTL. INC.

based on another transmission technology. While it is often depicted as the ideal LAN-WAN-LAN network solution, frame relay is not limited to fast packet technology. Vendors have recently developed frame relay interfaces for conventional packet and circuit switched networks, and LAN internetwork and WAN vendors are teaming up to develop frame relay capabilities for remote bridges and routers, offering integrated LAN/WAN solutions to customers.

Gateway: A protocol converter that restructures packets of information so they can pass between networks using different standards.

***Hub:** A central device, usually in a star topology LAN, to which each station's wiring is attached.

Integrated Services Digital Network (ISDN): Project underway for standardization of operating parameters and interfaces for a network that will accommodate a variety of mixed digital transmission services.

Interface: The physical connection between two communications devices, comparable to an electrical plug and socket connection with "male" and "female" components.

Internet(work): Two or more LANs linked together. A local internet is confined within a single building; a campus internet includes two or more nearby buildings.

Multiplex: To interleave or simultaneously transmit two or more messages on a single channel.

Multipoint: Pertaining or referring to a communications line to which three or more stations are connected. It implies that the line physically extends from one station to another until all are connected. (Contrast with point-to-point.)

Network Redundancy: A communications pathway that has additional links to connect all nodes in case one link goes down.

Network Topology: Describes the physical and logical relationship of nodes in a network, the schematic arrangement of the links and nodes (for instance, bus, ring or star), or some hybrid thereof.

Open Systems Interconnect (OSI): A classification of standards for promoting global connectivity. OSI standards are generally promulgated by the International Standards Organization and used by a variety of standards-setting bodies. The **OSI Reference Model** is a logical structure for network operations standardized within the OSI. It consists of seven layers, each of which performs a specific set of functions. For example, the first, or lowest, layer establishes the physical connection and interface to the transmission medium, while the third governs call setup, network routing and traffic control.

Packet Switching: A data communications technique where a message is broken down into fixed-length units (packets), which are then transmitted to their destination through the fastest route. Although all units in a message may not travel the same pathway, the receiving station ascertains that all units are received and in proper sequence before forwarding the complete message to an addressee.

Point-to-Point: Describes a circuit that connects two points directly, where there are generally no intermediate processing nodes, although there could be switching facilities.

The Evolution of LAN Standards

The number of technologies available for local area networking, and the number of practical combinations of those technologies, creates both opportunity and confusion. Two major efforts have been made to lessen the confusion by establishing standards: Committee 802 of the IEEE's effort to legislate standards in advance of the market, and the vendor attempt, initially led by the Ethernet vendors, to establish de facto standards by making their interfaces widely available at low cost.

The IEEE's Standard 802.3 was published in 1983 and has been adopted by the ISO. It describes a baseband, CSMA/CD network—similar to Ethernet—and includes several variations.

IEEE 802.3 Specifications for Local Area Networks

VARIATION	BANDWIDTH	MEDIA	DISTANCE	TOPOLOGY
10BASE-5 (Standard Ethernet)	10Mbps	"Thick" coaxial cable	500 meters	Bus
10BASE-2 ("cheaper-net")	10Mbps	"Thin" coaxial cable	200 meters	Bus
10BROAD-35 (Broadband Ethernet)	10Mbps	CATV coaxial cable	3.6 kilometers	Bus
1BASE-5 (1Mbps Starlan)	1Mbps	Twisted-pair wire	500 meters	Star
10BASE-T (10Mbps Starlan)	10Mbps	Twisted-pair wire	100 meters	Star

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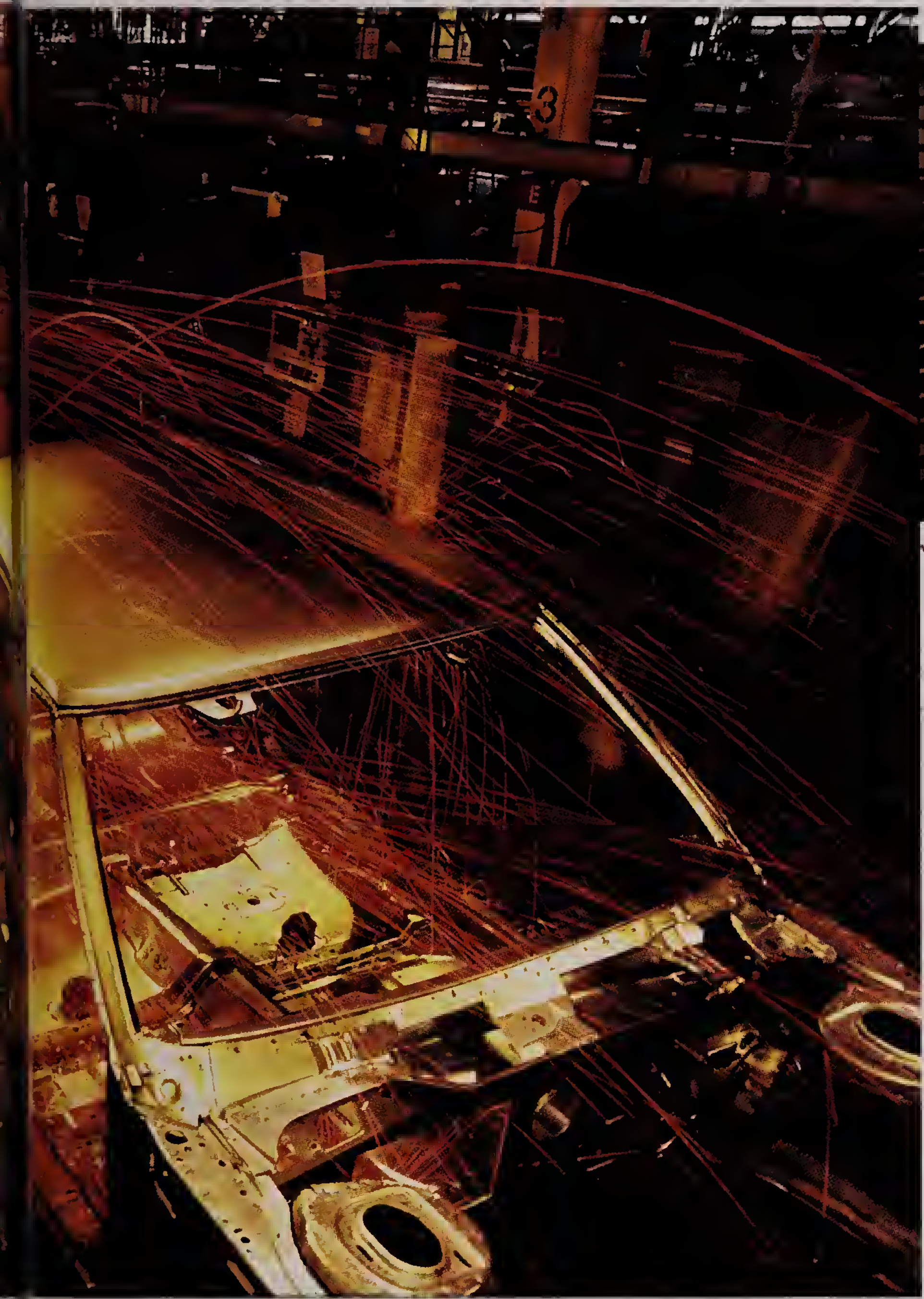

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Protocol: A collection of rules, voluntarily agreed upon by vendors and users, to ensure that the equipment transmitting and receiving data understand each other. In general, protocols comprise three major areas: the method by which data is represented or coded (e.g., ASCII), the method by which the codes are received (e.g., synchronously or asynchronously), and the methods used to establish control, detect failures or errors, and initiate corrective action. Terminals performing the same functions under different protocols cannot be used on the same system without protocol converters or emulators.

Router: A sophisticated, protocol-specific device that examines data and finds the best route for it between sender and receiver. Selects the cheapest, fastest or least-busy of all available routes. Routers are preferable to bridges for large networks with relatively low bandwidth connections.

***Simple Network Management Protocol (SNMP):** A protocol recommended by the Internet Engineering Task Force (a committee of vendors and academics formed to set standards) for managing internetworked LANs and packet switched networks; most commonly employed in TCP/IP (see below) networks.

Software-Defined Network (SDN): Also known as virtual private networks, SDNs use the carrier's public telephony network to provide the network functions of private lines. Users can design, change and manage a national network without investing in capital equipment or managing switches and leased lines. AT&T, MCI and US Sprint all offer SDNs.

Standard: A document that recommends a protocol, interface, type of wiring or some other aspect of a network. It may even recommend something as general as a conceptual framework or model (for instance, a communications architecture). Standards are developed by internationally or nationally recognized standards bodies or vendors. So-called "de facto standards" are widely used vendor-developed protocols or architectures, such as IBM's Systems Network Architecture (SNA).

***Switched Multimegabit Data Service (SMDS):** A packet switching data service that provides wide area data transport speeds up to 45 megabits per second. SMDS offers group addressing, connectionless transport and strict packet delay objectives.

Synchronous Optical Network (SONET): A North American carrier standard developed by Bellcore that works within the digital hierarchy. SONET-based products offer public-carrier connection of widely distanced LANs at native LAN speeds and are now available from AT&T, Northern Telecom and others. Offered in basic building blocks of 50 Mbps, SONET services allow users to construct a single bitstream of up to 13 billion bits in bandwidth.

Synchronous Transmission: Timing is achieved by transmitting sync characters prior to data. It does not use such redundant information as the start and stop bits in asynchronous transmission to identify the beginning and end of characters, and is thus faster and more efficient.

T-Carrier Services: High-speed private-line digital transmission services that provide large-volume transmission between two stations. T1, the most common T-carrier service, consists of 24 circuits, each transmitted at 64 Kbps for an aggregate rate of 1.544

Valuable Sources

As part of its survey, *CIO* asked respondents to name the vendors that play the most important role in distributed computing at their companies. The categories considered were hardware, software and communications and networking.

CIO DISTRIBUTED COMPUTING SURVEY

Primary Vendors*

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70%	IBM
35	Digital
19	Apple
13	Compaq
13	Hewlett-Packard
7	NCR
6	Tandem
5	Sun
5	Unisys
4	Wang

Software

24%	IBM
23	Microsoft
17	Novell
13	WordPerfect
12	Lotus
11	Computer Associates
11	Digital
11	Proprietary Software
6	Ashton-Tate
4	ASK
4	Oracle
4	Sybase

Communications and Networking

27%	Novell
25	IBM
21	AT&T
13	Digital
8	Northern Telecom
7	Codex
7	MCI
4	Banyan
4	Cisco
4	US Sprint

**Vendors mentioned by at least 4 percent of respondents.*

Mbps. (T2, T3 and T4 are rated at 6.312 Mbps, 44.736 Mbps and 274.176 Mbps, respectively.) T1 channels are six to 30 times more cost-effective on a per-bit basis than voice-grade lines, but users must be able to fill the 1.544 Mbps channel to take full advantage of savings. **Fractional T services**, however, enable businesses to lease a fraction of a T line.

***Transmission Control Protocol/Internet Protocol (TCP/IP):** A protocol suite for networking and internetworking that incorporates the required functionality of layers three and four of the OSI Reference Model. TCP/IP ensures that packets of data are delivered to their destination in the sequence in which they were transmitted. Originally developed for the U.S. military's ARPANET network, it has gained overwhelming popularity in the commercial sector as well.

Very Small Aperture Terminal (VSAT): An earth station with a small antenna, usually 6 meters or less. Used in conjunction with orbiting satellites for point-to-multipoint data networks, they have dramatically lowered the cost of satellite communications.

Virtual Private Network: See Software-Defined Network.

***Workstation:** A powerful microcomputer that features a sophisticated graphical user interface and the processing power of a minicomputer.

SOURCE: DATAPRO RESEARCH

Service Plus

Value-added network providers offer more than just a good connection

Value-added networks (VANs) are public data-communications networks that provide basic transmission facilities (generally leased by the VAN vendor from a common carrier) plus additional "enhanced" services, such as computerized switching, temporary data storage, protocol conversion, error detection and correction, and electronic mail. They provide an economical and viable data communications alternative to conventional leased lines. All VANs listed below (except IBM) support the X.25 protocol; most support others as well.

Value-Added Networks

VENDOR & LOCATION	NAME OF SERVICE	NETWORK TYPE	VALUE-ADDED FEATURES
AT&T Basking Ridge, N.J.	**ACCUNET**	data terrestrial	E-mail, error correction, transaction services
	EasyLink	data terrestrial	Global E-mail, facsimile, news service, EDI, telex
Automatic Data Processing (ADP) Ann Arbor, Mich.	**ADP Autonet**	data terrestrial satellite	E-mail, error correction, dial backup, PC support
BT Tymnet San Jose, Calif.	**Tymnet Global Network***	data terrestrial satellite	E-mail, facsimile, dial backup, error correction, PC support, databases, protocol conversion, enhanced security, EDI
CompuServe Columbus, Ohio	**CompuServe Network Services**	data terrestrial satellite	E-mail, dial backup, error correction, databases, EDI, protocol conversion, dynamic adaptive routing
Cylix Communications Memphis, Tenn.	**Cylix Value-Added Network**	data terrestrial satellite	Dial backup, disaster recovery, error correction, hybrid network
Infonet El Segundo, Calif.	**INFONET**	data terrestrial	E-mail, dial backup, error correction, PC support
GE Information Services Rockville, Md.	**MARK*NET**	data terrestrial satellite	E-mail, facsimile, databases, protocol conversion, network management, EDI, dial backup/security
Graphnet Teaneck, N.J.	**Freedom Network II**	data terrestrial satellite	E-mail, EDI, facsimile, dial backup, PC support, databases, packet/circuit switching, digital multiplexing
IBM Tampa, Fla.	**IBM Information Network**	data terrestrial	E-mail, EDI, satellite, application programs, databases, remote computing services
US Sprint Reston, Va.	**Sprintnet*** (formerly Telenet)	data terrestrial	E-mail, dial backup, error correction, PC support, databases, facsimile
Unitel Communications Toronto	**FasPac Data Services**	data	E-mail, dial backup

**Tymnet and Sprintnet together make up 86 percent of the market.*

SOURCE: DATAPRO RESEARCH

Setting the Standards

A communications standard is really just a set of guidelines that a lot of people agree to use. All of the standards listed below are accepted and used in the United States (with the exception of EDIFACT, which is primarily a European standard). Most are used in Europe to varying degrees, and there are ISO equivalents for most IEEE specs.

Each standard is specific to a certain kind of network layout; for example, CCITT's X.25 governs packet switched wide area networks. As far as EDI goes, most people choose a standard based on what their particular industry is using at the time.

The Open Systems Interconnect (OSI) set of standards encompasses a number of different standards. They are usually, but not always, set by ISO, and then adopted by other standards bodies. Most CCITT and IEEE standards are ISO-approved (or pending approval).

The term "de facto standard" refers to a protocol, interface or architecture developed by a particular vendor or organization and often adopted by others (for instance, SNA, TCP/IP, SNMP [see glossary]). They are called standards because they have won wide acceptance in the marketplace. The following charts include only those standards that have been set by one of the formal standards-setting bodies.

The Standards Bearers

INITIALS	FULL NAME & LOCATION	DESCRIPTION	STANDARDS
ANSI	**American National Standards Institute** New York	U.S. representative to ISO.	X12 FDDI Cooperates with ISO, CCITT & IEEE standards
CCITT	**Consultative Committee on International Telephony and Telegraphy** Geneva	Standards-setting committee of the International Telecommunications Union.	V.32 X.25 X.400 ISDN Works with ISO on OSI
ECMA	**European Computer Manufacturers Association** Geneva	Vendor consortium. Sets standards in Europe for computer and communications technology.	Works in cooperation with ISO, CCITT and U.S. organizations
IEEE	**Institute of Electrical and Electronics Engineers** New York	Sets data communications standards.	802.x LAN standards
ISO	**International Standards Organization** Geneva	Non-treaty organization to promote standards. Every representative country gets one vote. ANSI is U.S. representative.	Sets OSI standards ISO 7498 (OSI basic reference model) ISO 8571 (FTAM) ISO 9735 (EDIFACT) ISO 9596 (CMIP) ISO 9072 (ROSE)

SOURCE: DATAPRO RESEARCH

Standard Brands

STANDARD	DEVELOPED BY
AMIS* Audio Messaging Interchange Specification	**AMIS**
CMIP Common Management Information Protocol	**ISO**
EDIFACT EDI for Administration, Commerce and Transport	**ISO**
FDDI* Fiber Distributed Data Interface	**ANSI**
FTAM File Transfer, Access and Management	**ISO**
IEEE 802.x	**IEEE**
ISDN* Integrated Services Digital Network	**CCITT**
ISO 7498	**ISO**
ISO 8571	**ISO**
ISO 9072	**ISO**
ISO 9596	**ISO**
ISO 9735	**ISO**
ROSE Remote Operations Service Elements	**ISO**
SONET* Synchronous Optical Network	**Bellcore**
V.32	**CCITT**
X12	**ANSI**
X.25	**CCITT**
X.400	**CCITT**
X.500*	**CCITT**

**Emerging standard*

SOURCE: DATAPRO RESEARCH

DESCRIPTION
Voice messaging standard developed by a consortium of users and vendors. Specifications have been completed but not yet voted on.
Popular name for ISO 9596. A network management protocol, recently finalized and now being implemented by the OSI Network Management Forum.
Popular name for ISO 9735. Addresses EDI in the global market. (Compare with X12.)
Applies to high-speed fiber-optic LANs (100 Mbps). Four variations (three of which are finished) apply to different aspects of fiber-based communications and control.
Popular name for ISO 8571. Used for file transfer among OSI systems.
Principally LAN Standards (except for IEEE 802.6, which is used for WANs).
Project underway to define operating parameters and interfaces for a network that will accommodate a variety of mixed digital transmission services.
OSI basic reference model.
Same as FTAM. File transfer among OSI systems.
The same as ROSE. Defines functions involving shared remote applications.
The same as CMIP.
Same as EDIFACT. Addresses EDI in the global market.
Popular name for ISO 9072. Defines functions involving shared remote applications.
North American carrier standard that works within the digital hierarchy to connect widely distanced LANs at native LAN speeds.
Specifies modem transmission at 9,600 bps. Includes error-checking.
Addresses EDI in the domestic market. (Compare with EDIFACT.)
Defines the interface between data termination equipment and data communications equipment for terminals connected to packet switched data networks.
Defines formats for globally compatible electronic mail and other message-oriented information exchange.
Defines global electronic directory, somewhat like the telephone company's white pages. Coding will be hierarchical, with different codes for specific countries, organizations, equipment and applications.

Sorcerers' Apprenticeships

*Colleges & Universities with Programs in Telecommunications**

Barry University
Miami Shores, Fla.

Carnegie-Mellon University
Pittsburgh

Christian Brothers University
Memphis, Tenn.

City University
Bellevue, Wash.

Colorado, U. of
Boulder, Colo.

Columbia University
New York

Denver, University of
Denver

De Paul University
Chicago

George Washington U.
Washington

Georgia Institute of Tech.
Atlanta

Golden Gate University
San Francisco

Harvard University
Cambridge, Mass.

Hawaii, University of
Honolulu

Houston, University of
Houston

Indiana University
Bloomington, Ind.

Iona College
New Rochelle, N.Y.

Iowa State U. of Science & Tech.
Ames, Iowa

Kansas, University of
Lawrence, Kan.

Marylhurst College
Marylhurst, Ore.

Mass. Institute of Tech.
Cambridge, Mass.

Miami, University of
Miami

Michigan State University
East Lansing, Mich.

Missouri at Kansas City, U. of
Kansas City, Mo.

National University
San Diego

New Haven, U. of
West Haven, Conn.

New York University
New York

North Carolina State U.
Raleigh, N.C.

Northeastern Illinois U.
Chicago

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Athens, Ohio

Pace University
White Plains, N.Y.

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Philadelphia

Pittsburgh, University of
Pittsburgh

Polytechnic University
Brooklyn, N.Y.

Saint Louis Community C. at Florissant Valley
St. Louis

Saint Mary's College
Winona, Minn.

San Francisco, University of
San Francisco

Southern California, U. of
Los Angeles

Southern Methodist University
Dallas

Southern Mississippi, U. of
Long Beach, Miss.

Stevens Institute of Technology
Hoboken, N.J.

Syracuse University
Syracuse, N.Y.

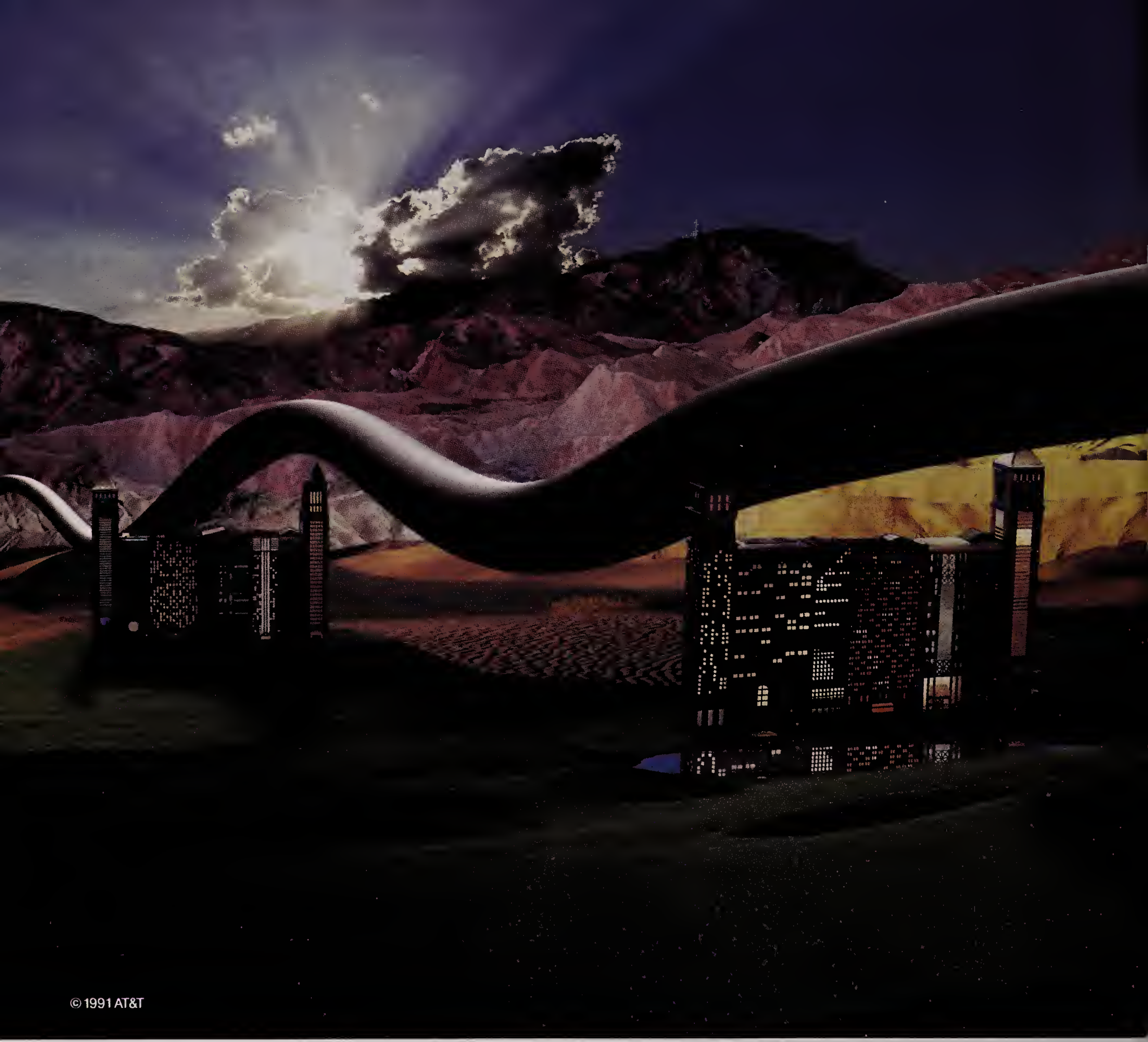
Texas at Austin, U. of
Austin, Texas

West Virginia University
Morgantown, W.V.

Wisconsin at Madison, U. of
Madison, Wis.

**All schools offer graduate studies; some also offer four-year undergraduate programs, certificate courses or doctorate programs.*

SOURCE: DATAPRO RESEARCH



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Cutting the Cord

The next step in your organization's pursuit of ultimate connectivity may be to sever some of its hardwire connections

BY SCOTT WALLACE

Just when you're getting comfortable with the thought that your local area networks are serving your organization well, along comes a family of new technologies that will make you think again: wireless networks. The good news is, you don't have to pay attention to wireless networks if you don't want to. The bad news is, you're going to want to.

One good reason to pay attention is cost: the cost of buying, installing, modifying and removing network cabling. David Kerr, associate director of communications consulting at BIS Strategic Decisions (formerly BIS CAP International) in Norwell, Mass., estimates that the expense of a wireless network node can typically be recovered in two or three moves of a network station (such moves on a wired network not only entail the actual cost of the rewiring but also the inevitable downtime waiting for the technician to catch up with the furniture movers). In atypical circumstances—such as in an older building or when cabling through asbestos-clad construction—wireless networks are even more attractive.

ILLUSTRATION BY MARYANNE LLOYD

Wireless networks also warrant consideration when it would be impractical or impossible to install a wired LAN. Perhaps your organization has a small branch or a subsidiary without the expertise needed to install or relocate a wired network. Maybe temporary quarters are a part of your operations. Or perhaps you place special teams at client sites where installing your own wired network is simply not an option.

There are three basic technical approaches to local area wireless networks in use today. Two require use of the FCC regulated spectrum; these are spread spectrum technology (SST) and Motorola's 18 GigaHertz (GHz) radio network. The third approach uses infrared light: light with wavelengths below the range of human vision. Among the currently available products using these approaches you will find good wireless range, excellent security, low cost per network node, and standardized network protocols and interfaces. Unfortunately, today you won't find all in any one product.

In April 1990 the FCC modified rules concerning the use of the 18 to 19 GHz frequencies to enable low-power radio communications within buildings in the Digital Termination Services (DTS) band. In any given geographic area 35 miles in diameter, up to five FCC DTS licenses are available, each permitting the use of two individual frequencies. Shortly after the FCC rules were modified, Motorola Inc.—well known for its ra-

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dio and cellular telephone products—began to accumulate DTS licenses in every metropolitan area with a population of over 30,000. In October 1990, Motorola, whose cellular division is based in Arlington Heights, Ill., demonstrated its prototype wireless networking technology based upon the 18 GHz frequency. And at the NetWorld '91 show in Boston, Motorola rolled out Altair, an Ethernet-compatible wireless in-building network (WIN) based upon its nonexclusive 18 GHz licenses.

Motorola's technology uses 10 MHz wide channels with time-division (as opposed to frequency-division) duplex multiplexing to ensure signal separation, sufficient data rates, reliability and data integrity. Delivering a wireless network required the development and integration of four technology building blocks: a miniaturized radio transceiver, an intelligent antenna system, a digital signal processor (DSP) tailored to the network's radio signals and an application-specific integrated circuit (ASIC) for high-speed data handling. The company has built all of this into networking modules that measure 11 inches deep, eight inches wide and three inches high and weigh seven pounds.

One characteristic of the network's 18 GHz frequency range is that the radio signals dissipate quickly. The Altair network's coverage is focused on the workgroup or department, and maximum range is between 40 feet (for transmission through three walls) and 130 feet (if the area is open space). Because each site is licensed to use two frequencies, side-by-side networks can operate without interference, and wireless LANs can be linked together to extend network range.

Each Altair WIN "microcell," or subnet, consists of a single control module, which connects to an Ethernet backbone and is mounted from seven to 15 feet from the floor, and up to six user modules, which connect to Ethernet devices such as PCs, workstations or printers. Each user module can support as many as six devices; however, each microcell can support no more than 32 users altogether. Data communication between the control module and the user module supports Ethernet's standard of 10 megabits per second. Within each microcell, the network is subject to the same design considerations and throughput restrictions faced when a wired Ethernet is segmented.

The control module is priced at $3,995; user modules cost $3,495 apiece. Motorola is positioning Altair as an add-on to existing 802.3 (Ethernet) networks, with its primary use being to service the "last 100 feet." In the future, Motorola is expected to link Altair to cellular-based communications, to further miniaturize the control and user modules and to increase the network data speed. Installing Altair requires filing a simple FCC-required agreement; moving Altair-equipped workstations beyond the range of its existing network involves clearing the new location with Motorola's Frequency Management Center via a toll-free telephone call.

> *Infrared networks are not within the FCC's jurisdiction and are completely immune to radio-frequency interference and interception. The trade-off is that infrared LANs only operate in open, unwalled spaces.*

Spread spectrum technology (SST) was developed during World War II because its resistance to eavesdropping and jamming ensured secure and reliable radio communications. Spreading a radio signal across a range of frequencies—as opposed to transmitting on a single frequency—allows the power of each transmission to be lower, making messages much more difficult to detect and intercept. Spread spectrum also uses message redundancy, making signals highly resistant to jamming even if transmission frequencies are identified.

There are two popular approaches to data communications using spread spectrum transmissions. In the "direct-sequence spread spectrum" approach, each bit of information is replicated many times and transmitted as "chips." The chips are received and, using a unique spreading code, reassembled into the original bit. The use of multiple chips to convey a single bit provides the reliability; the use of the unique spreading code provides the security.

In the second popular approach to SST data communications, multiple chips are transmitted on a specific sequence of frequencies, where each frequency is used only for a very short duration. This "frequency-hopping spread spectrum" approach provides security through its unique hopping pattern.

For 40 years SST was used almost exclusively by the military. In 1985 the FCC approved three bands of frequencies for unlicensed SST uses, ushering in an era of civilian deployment of spread spectrum technology. Wireless data communication is among the earliest commercial uses of SST, and NCR Corp., headquartered in Dayton, Ohio, is one of the first companies to introduce SST-based data communication products.

NCR's direct-sequence spread spectrum WaveLAN interfaces to Novell networks through a single-slot IBM PC/AT card connected by a five-foot coaxial cable to an omnidirectional antenna about the size of a deck of cards. WaveLAN is compatible with MS-DOS and Novell Netware and today supports a two-megabit-per-second data rate with a maximum range of from 250 to 1,000 feet, depending upon building structures. Transmissions are not blocked by normal office constructions but can be disrupted by thick concrete or metal.

Tying the WaveLAN wireless network into an existing LAN is as simple as interfacing one or more of the wireless stations to the wired network. This feature makes it easy to drop WaveLANs off a wired backbone. Unlike other wireless networks, WaveLAN imposes no limit on the number of users that may be on a single network. In addition, multiple networks can be established in the same transmission space because the WaveLAN protocol for network traffic includes a network identifier. Since they require no FCC licenses, WaveLAN-equipped workstations can be moved wherever and whenever needed.

With a suggested list price of $1,390, which includes the interface card, antenna and cable, WaveLAN compares favorably with wired networks. A Data Encryption Standard security option is available for $90 per node. NCR has stated its plans to expand support to additional network and workstation platforms, to offer a point-to-point antenna for communications between buildings, to increase the WaveLAN data rate to 10 megabits and beyond, to integrate wireless voice and data, and to support the networking of portable and notebook PCs. The company's direct involvement in the development of wireless network standards (through the IEEE 802.11 committee) affirms NCR's commitment to the broad use of wireless networks.

Infrared-based data transmission has been available for a number of years, but only recently has the technology matured to support local area network speeds. Unlike radio-based wireless networks, infrared networks are not within the FCC's jurisdiction and are completely immune to radio-frequency interference and interception. The trade-off is that infrared LANs only operate in open, unwalled spaces because there must be an unobstructed line of sight between transmitters and receivers.

BICC Communications, located in Auburn, Mass., manufactures and markets an IEEE 802.5-compliant (token ring) infrared network that currently supports data rates of four and 16 megabits per second. The company's product, InfraLAN, uses a baseband modulation technique that transmits and receives token ring data without altering the data rate or remodulating the data. The electrical signals provided by the token ring interface are used to drive InfraLAN's LED transmitters. As each bit of data is presented to the transmitter, its high or low electrical voltage is converted into a high- or low-intensity infrared signal and transmitted at a wavelength of 870 nanometers. When the infrared bit is received, a similar conversion takes place to provide the token ring interface with electrically encoded data. This approach avoids the engineering and manufacturing overhead—and expense—which is borne by wireless networks with data streams that differ in speed or format from the wired network data stream.

Wireless networks are offering LAN users options for extending, expanding and replacing their current wired networks. As wireless technologies start to support portable and laptop units, usefulness and demand will increase.

Workstations and networks interface to InfraLAN transparently, as if the wireless LAN were an 802.5 network. As a result there is no need for new interface cards, cables or software. The InfraLAN system costs $2,995 and consists of a pair of optical transceivers and a base unit that supports six 802.5 devices, or five devices if one of the base unit's ports is connected to a network. The transceivers can be separated by as much as 80 feet and are very simple to set up and to aim.

BICC recommends a dual counter-rotating ring topology, so that if one ring is interrupted, the second hot-redundant ring will instantly and seamlessly take over. This means that in a typical installation, the base unit's transceivers will be located at different heights or in different orientations to office traffic or other likely interrupters of the line of sight needed for the infrared connection.

BICC positions its wireless LAN as an enhancement to cabled local area networks, one that provides considerable flexibility and requires only minutes to install or reconfigure. The company has taken a very conservative approach to implementing its technology and expects to be able to support much higher data rates, such as FDDI, with minor technical enhancements.

Each technology and product has shortcomings compared to the strengths of the others. But notwithstanding their various restrictions, wireless networks are offering LAN users robust options for extending, expanding and replacing their current wired networks. As wireless technologies start to support portable and laptop units, usefulness and demand will only increase.

Analysts are projecting slow growth of the wireless LAN market, largely due to the lack of an open, nonproprietary offering. But this consideration is not likely to restrain organizations where wireless networks provide significant cost/performance or competitive advantages. For them, selecting a technology and a product will be a matter of carefully reviewing network requirements to ensure the best match to their circumstances.

Scott Wallace is an independent computer industry analyst and journalist in Warwick, Mass.

EVENTS

The 2nd Annual Conference on Strategic Automation for Retailers

Infomart, Dallas
June 4-6
Retail Systems Alert
617 527-4626

Staying competitive through strategic applications of retail technology is the focus of this second annual conference. Speakers describe how their companies use technology to improve retail operations. Management seminars, technical case studies and vendor exhibits are also offered. Registration fees: $495 for subscribers; $595 for nonsubscribers.

Computer Security Conference Denver '91

Denver Marriott City Center, Denver
June 10-12
Computer Security Institute
503 624-2904

This conference explores topics in computer security. General session speakers, panel discussions and 42 in-depth workshops are offered. Topics include local area networks, management issues, telecommunications systems and office automation. Registration fees: $125-$990.

The Network Computing Symposium

Holiday Inn Crowne Plaza, Arlington, Va.
June 11-14
Technology Transfer Institute
213 394-8305

This program covers strategic, managerial and productivity aspects of network systems. Topics include internetworking enterprisewide LANS, client/server architectures, distributed computing, PC LAN strategies and GUIs. Registration fees: $795-$1,095.

CISR Summer Session '91

Hyatt Regency Hotel, Cambridge, Mass.
June 17-20
Center for Information Systems Research
617 253-6657

This seminar is aimed at senior level information systems managers and focuses on the ways in which technology enables changes at the workgroup, firm and industry levels. Topics cover managerial, organizational and technical issues related to the role of information technology in the business environment. Registration fee: $2,400.

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Editorial, Advertising and Business Offices: 492 Old Connecticut Path, PO Box 9208, Framingham, Massachusetts 01701-9208–(508) 872-8200. **Postal Information:** CIO (ISSN 0894-9301) is published monthly by CIO Publishing Inc., 492 Old Connecticut Path, PO Box 9208, Framingham, Massachusetts 01701-9208. Second-class postage paid at Framingham, MA, and at additional mailing offices. **Reprints:**

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FYI

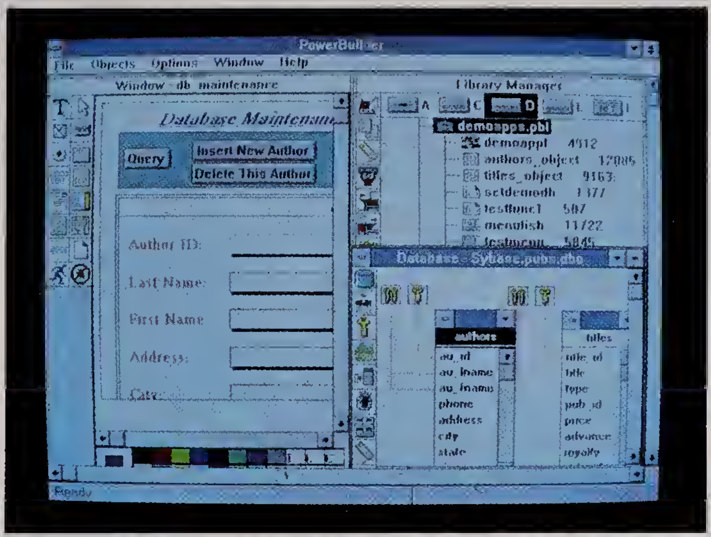
Freedom of Voice

Advances in telephonic technology have enabled all manner of improvements in customer service and employee productivity. One of the latest—Octel Communications Corp.'s Voice Information Processing Server—has brought together a variety of previously separate services to deliver integrated applications via a touch-tone phone. In a single call, users can guide themselves to databases, voice messaging, audiotex information, E-mail message notification, automated fax delivery or a person's extension. The system carries caller data, such as an account number, through the call and scans callers' profiles in the database to present them with personalized information and choices they can act on during the call.

The company's Unix-based 500D Data Module, which provides connectivity to multiple host computers and peripherals, is the component that gives existing Octel voice systems full voice information processing capabilities. The various applications and a system management tool range in price from $15,000 to $60,000, depending on purchase volume and whether or not the Data Module (not sold separately) is included in the purchase. While some of the applications are available now, others will be released during the summer and fall. For more information call 408 942-6500.

Picture This

If the language of client/server computing—seamless integration, easy cross-functionality and graphical user interfaces—has lacked development tools equal to the task of translating it into actual applications, Powersoft Corp. may be able to act as an interpreter. The company recently announced PowerBuilder, a new class of graphical, PC-based, client/server application development environment that enables programmers to "paint" graphical, integrated database applications by having the whole architecture picture as an element in the design process.



Traditional, hierarchical programming languages are cumbersome and do not address the client/server environment, according to Powersoft. PowerBuilder 1.0 operates in the Microsoft Windows 3.0 client environment and is geared to be server-independent, supporting industry standard SQL as well as the leading relational database management systems. PowerBuilder is licensed for $2,995 per developer, and is discounted by volume and configuration. For more information call 617 229-2200.

Turning the Tide

With budgets and programming staffs being slashed, it seems like application backlogs are growing faster than the federal deficit. To meet the ever-increasing productivity challenge, ASK Computer Systems offers a new 4GL application code generator designed to let programmers develop character-based business applications from their terminals.

The new INGRES/Vision environment features components that allow users to create applications visually and define data within a given frame. Other standard features include menu navigation aids, context-sensitive help facilities and pop-up selection lists for valid values. The INGRES/Vision architecture supports 3GL, 4GL, automatically generated sequential keys, local and global variables, and passing data between forms.

The product is immediately available for the DEC VAX/VMS environment. Availability for other platforms is expected later this year. Prices vary considerably, with discounts available for current INGRES 4GL users. For more information contact ASK at 800 4-INGRES or 415 769-1400.

Making Headlines

Desktop publish or perish is not a choice many businesses face. Increasingly, though, organizations are shifting publishing from specialized departments to users' desks. To make that process easier, Digital Equipment Corp. is introducing several products to its networked publishing program.

DECprint Printing Services for the VMS operating system is a layered software product that enables PostScript printers to be accessed from MS-DOS, OS/2 and Macintosh PCs, workstations and VMS VT time-sharing terminals. The DECfonts Typeface Collection is a set of Adobe Type 1 PostScript fonts for VMS and ULTRIX systems. An agreement with Adobe Systems allows users to license the outlines, bitmaps and font metrics. A DECprint license is packaged with Digital PostScript printers: The stand-alone license is $1,300. DECfonts is $420 per license. For more information call 603 884-2270.

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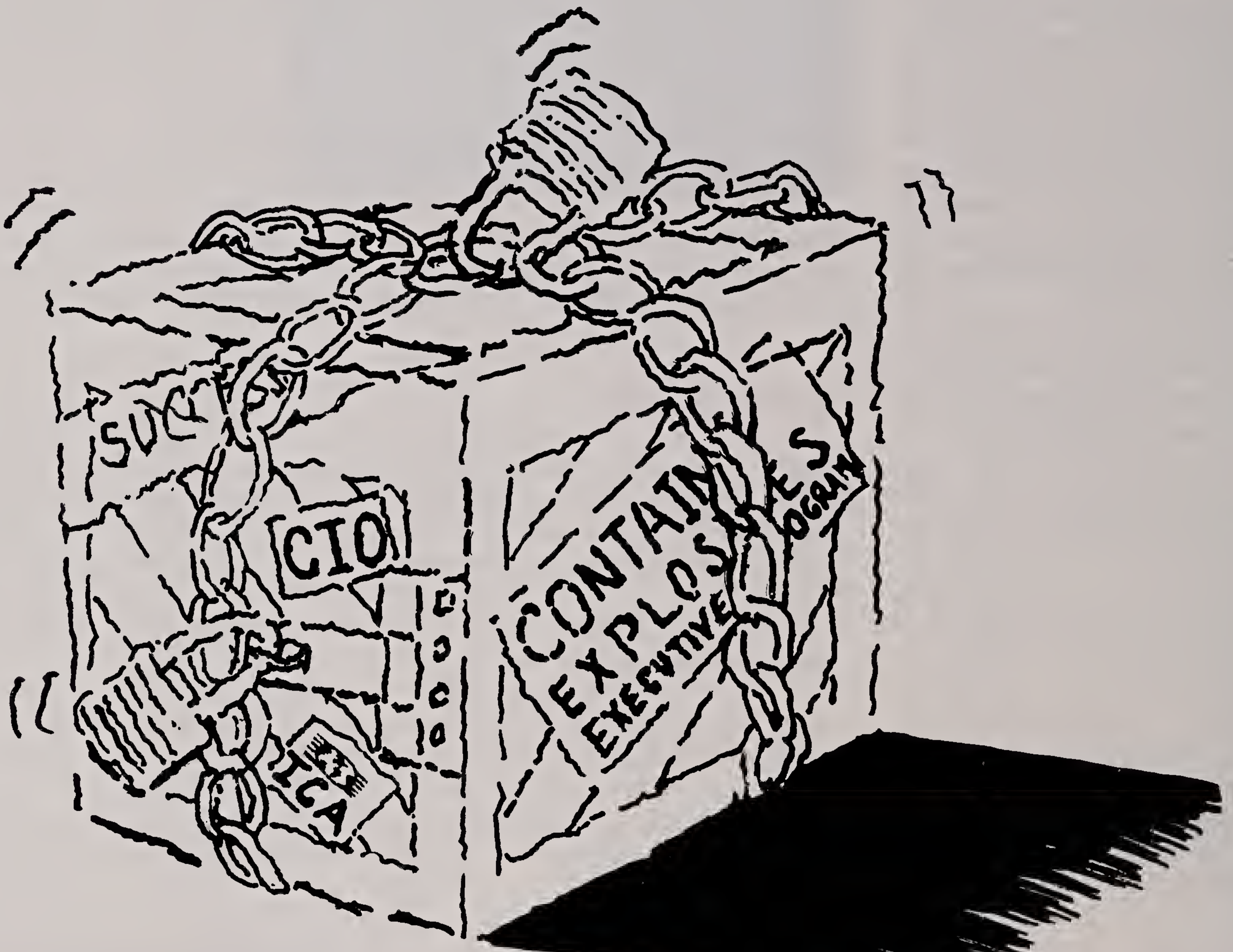

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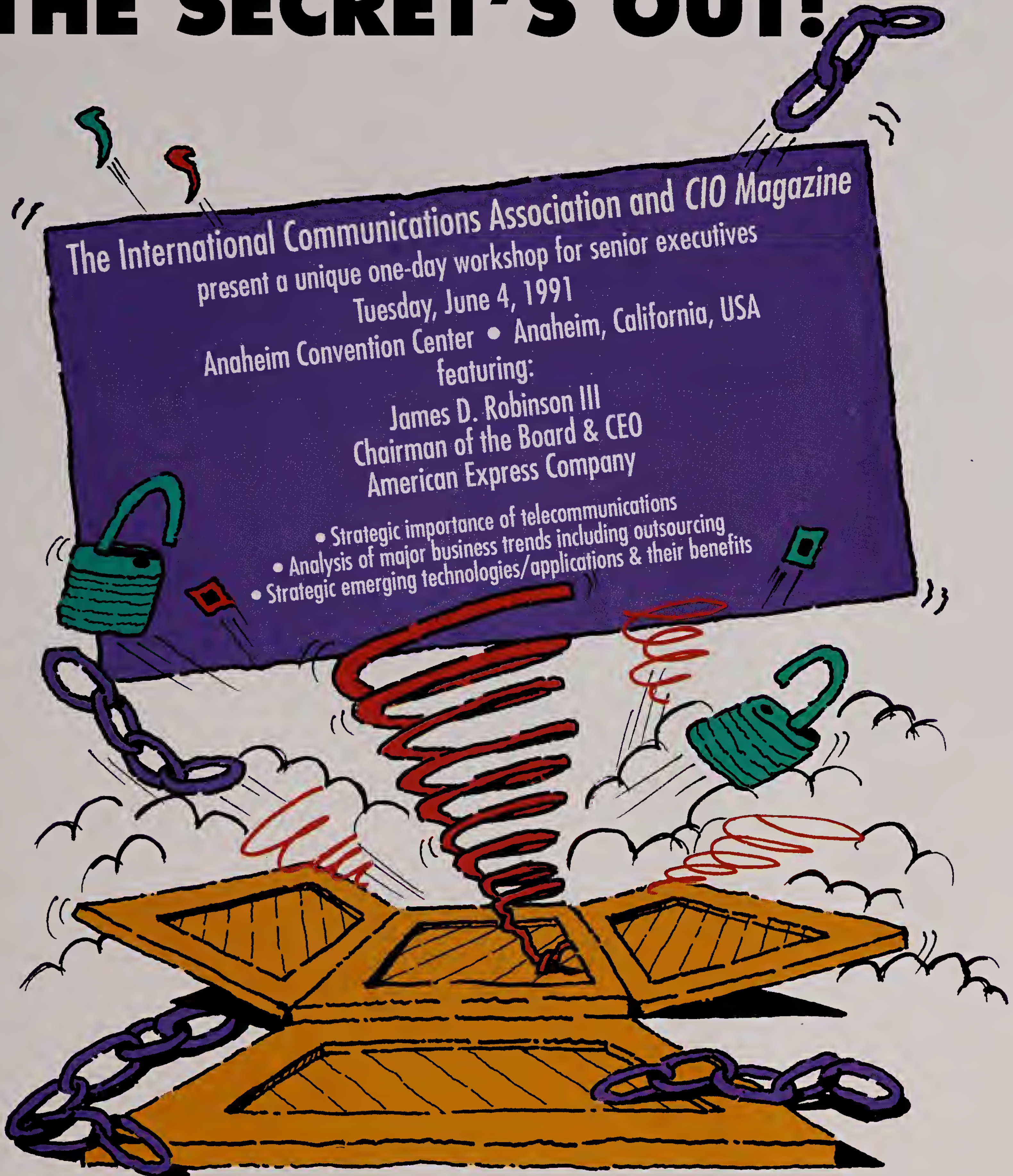

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CONFERENCE CALL

QUESTION: *What do telecom managers want to tell management?*

ILLUSTRATION BY BETHANY GULLY

Telecommunications managers have a tough job: They must link people and information resources to meet a thousand different needs, often without the authority to choose the technology investment or strategic direction needed to do the job right. They are understandably reluctant to roil the IS waters with blunt observations to this end, but if CIOs are going to make strategic use of telecom and convey its complexities to management, telecom people need to make themselves heard.

Thomas J. Bast

Vice president and director of telecommunications for Citicorp Global Payment Products in Lake Success, N.Y.

“It's very true that senior management doesn't understand the technical complexity of communications. I try to bring it down into English and put it into a business perspective. It takes me a heck of a long time to make my monthly reports understandable.

“I believe that an awful lot of technicians cannot relate technical issues to business issues—in terms of unit cost or the business risk of not doing things certain ways.

“I think my existence is as the interface between the technical and business sides. I manage down to the technicians to make sure that they understand the business issues, and up to management to make sure they understand the technical issues. Telecom is relatively new, and I think it's only a matter of time until you get some technical expertise in upper management.”

Bruce Sieben

Group manager of Data Center and Telecommunications Systems Services for Merrill Lynch & Co. in New York

“The key to the success of the CIO is to establish and implement a technology strategy that is aligned with the business strategy of the firm. The telecom manager must be able to provide the CIO with information about the current telecom services, the costs of those services as presented to the business units, and how those services help achieve the present and future goals of the business.

“Consequently, the telecom manager's first responsibility is to be accountable for the firm's global telecommunications strategy. Second, the manager must continually develop intelligent cost structures in conjunction with the core business units.

Finally, the telecom manager has responsibility for network optimization and automation, process and performance improvement, and contingency and recovery planning.

“Merrill Lynch's network and branch infrastructure is the systems basis of our competitive advantage and central to our planning efforts. Given that our costs and services are identifiable, and that we are informed about future business decisions, we can determine the best telecom alternatives to fit our needs.

“Both business and technical knowledge are key. With this knowledge we are able to state, in financial terms, what the benefits are of new products and services such as fast packet switching, the increased use of fiber optics, and further exploration of satellite technology.”

Joseph Gallo

Senior director of corporate telecommunications for ADP Inc. in Roseland, N.J.

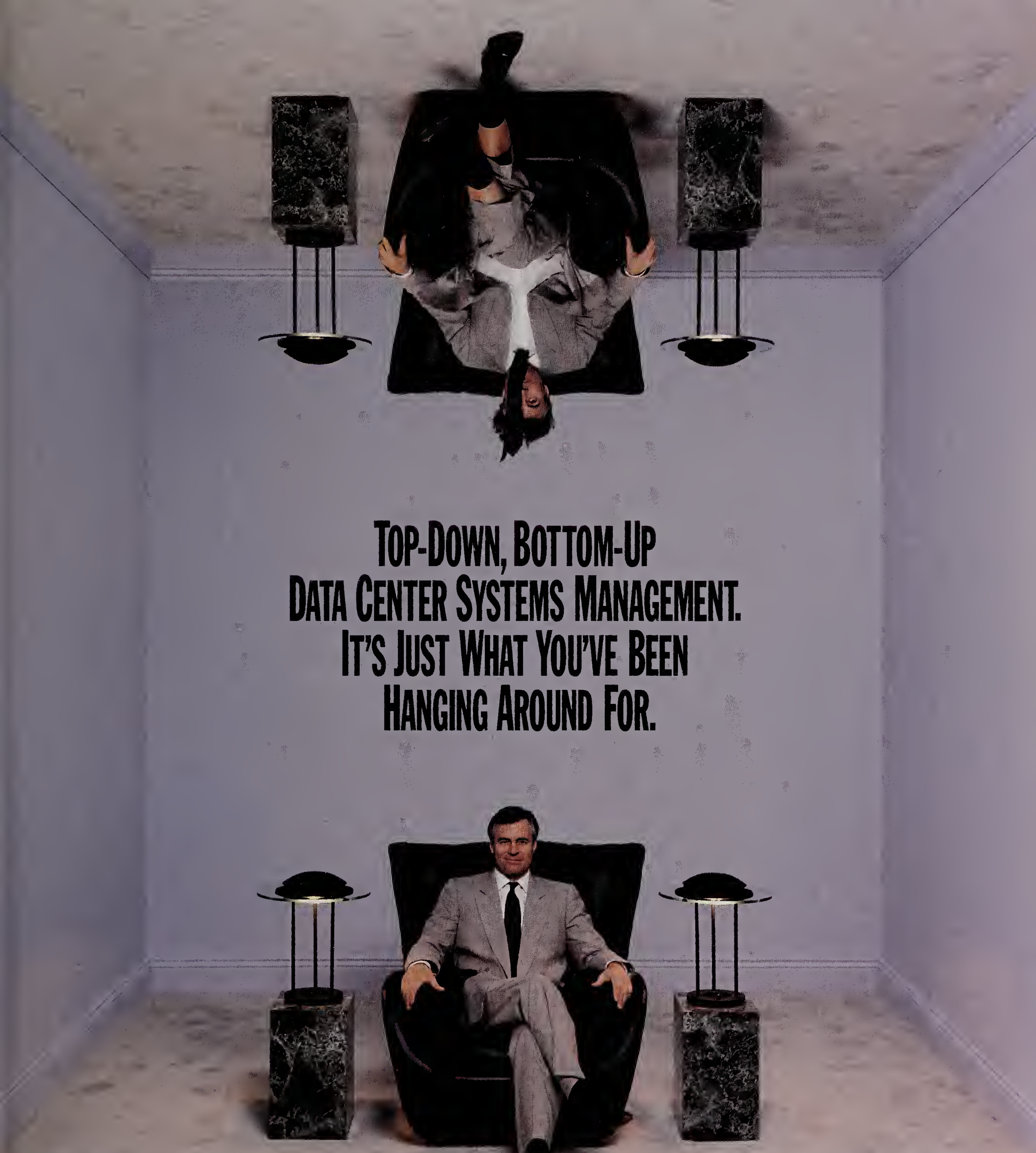
“I think there's a need for more of a partnership between telecom and the business decision-makers. I report to the CFO, and MIS is splintered throughout a number of business units, each of which has its own CIO. The perception is that telecom is subservient to MIS. What happens is that businesspeople are only looking for delivery—how can I get my service, my product, delivered fast and cheap? We have to be more in the mainstream, to understand what the developments and products are in order to help make delivery when they need it. Without that partnership, you lose time and you lose a presence in how a product is going to be delivered.

“That partnership has to be achieved in executive committee decisions and filter into the actual business units. There's a need for a chief networking officer. There have to be some corporate areas where networking becomes as important as finance.

“The complexities are not only cost and timely delivery, but choices. CIOs and upper management have to be aware of this. But that's really a telecom management issue. Telecom must be able to present that in the right way so those people understand it. It's the old marketing cliche: You can have the best idea, but if you don't know how to sell it, it's not going to go anywhere.

“I think you have to have a position for overall corporate telecom responsibility. I think a lot of companies still have a quasi-consultant function in the telecom areas. It needs to be a little bit more than consultant; you really need to be a partner.”

Readers are invited to suggest Conference Call questions. Contact Senior Writer Meghan O'Leary at 800 343-4935, ext. 4733, or by fax at 508 872-0618.



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